FACTORY

MANAGEMENT AND MAINTENANCE

MARCH 1948

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A McGRAW-HILL PUBLICATION

Here's why one engineer specified

"BYERS WROUGHT IRON PIPE" for replacements

In the course of a plant overhaul, a Pennsylvania engineer tore down an old ammonia condenser, installed just after the turn of the century.

The pipe was encrusted with sediment on the outside and to the casual glance seemed to be reaching the "end of its string." But careful inspection and testing told a different story . . . as the illustrations show.

The outside after cleaning showed a characteristic roughened surface, but was completely free of any deep local pits. Threads were still sharp and clean. A specimen was split in two and the inside was quite smooth. After cleaning it was very clear that almost no corrosion had occurred and the interior was in splendid condition.

It is probably unnecessary to say that the replacement piping selected by the engineer was Byers Wrought Iron.

This is only one of many instances where wrought iron has convincingly proven its durability by decades of trouble-free service. The unique nature of wrought iron makes it unusually resistive to corrosion. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and "detour" attack, thus discouraging local pitting. The fibers also anchor the initial protective scale, which shields the underlying metal.

If you are concerned with the selection of material for condensers or other heat exchangers, ask for our bulletin, "Wrought Iron for Refrigeration and Air Conditioning Systems."

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N. Y.

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GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

FACTORY

MANAGEMENT and MAINTENANCE

MARCH, 1948

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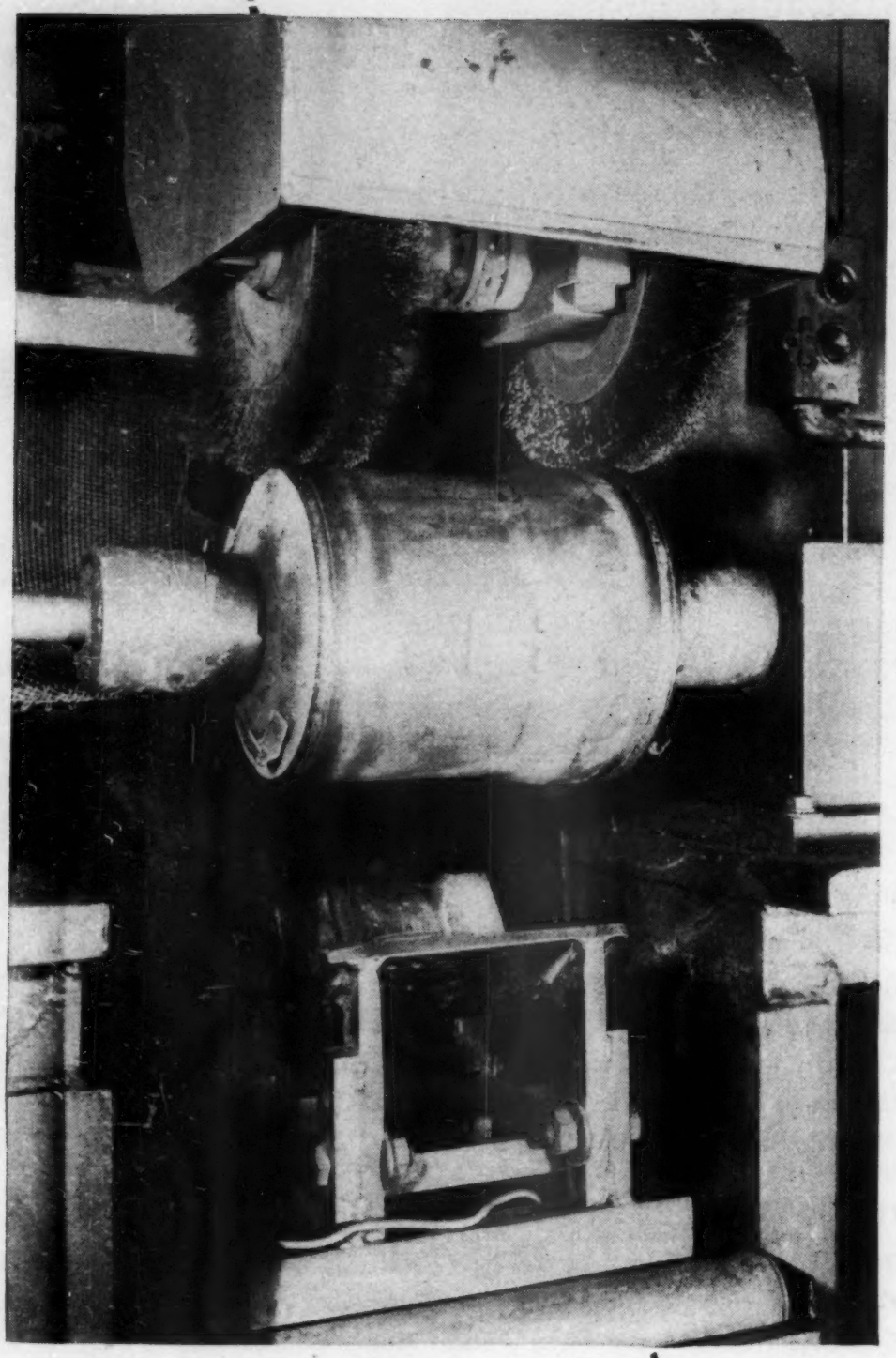

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FACTORY
MANAGEMENT AND MAINTENANCE

L. C. MORROW, EDITOR

DEALING WITH THE HUMAN FACTOR IN EMPLOYEE RELATIONS

THE human factor in employee relations is a topic much discussed. In most management gatherings it is certain to be said by somebody that industry loses sight of the human factor. That the people who direct industry are too intent, relatively, upon producing a product or making a profit. That they are so intent they forget the employee as a person. That they are prone to treat the worker as just so much machinery.

I think that on the whole these statements are exaggerations. Sometimes I wonder if some of them aren't mere parroting. They sound good and get attention. In saying this, I am prepared to admit that there is some justification for some of the statements. But I claim that most of them, when uttered as generalizations, are not justified.

I visit a good many industrial plants. I talk to a great many people engaged in the management of industry. I get reports every day from members of my staff who spend most of their time visiting plants and reporting upon management activities. Based on the first-hand data thus collected, it is my conclusion that the human factor is pretty close to the top in most management thinking in manufacturing plants.

Here are some of the human-factor items that I find industry doing something about, and doing it without reluctance:

Providing good places to work: Well-designed, comfortable buildings with much attention to temperature, ventilation, sanitation, lighting. Feeding. Medical attention. Group insurance.

Providing good bases for wage payment: Job evaluation. Time and motion study. Direct monetary incentives.

Providing trained supervision: Training conferences. Training courses. Foremen's clubs.

Providing trained personnel officers to deal with: Bargaining, grievances, personal problems.

In regard to these matters, I feel that industrial management is very much on the job.

There are, though, some things that ought to be done by management. And they have to do with the human factor, but not in the way the critics mean. I am thinking of such things as taking the necessary steps to convince the worker that:

1. Taking a job obligates him to meet standards of production and quality.

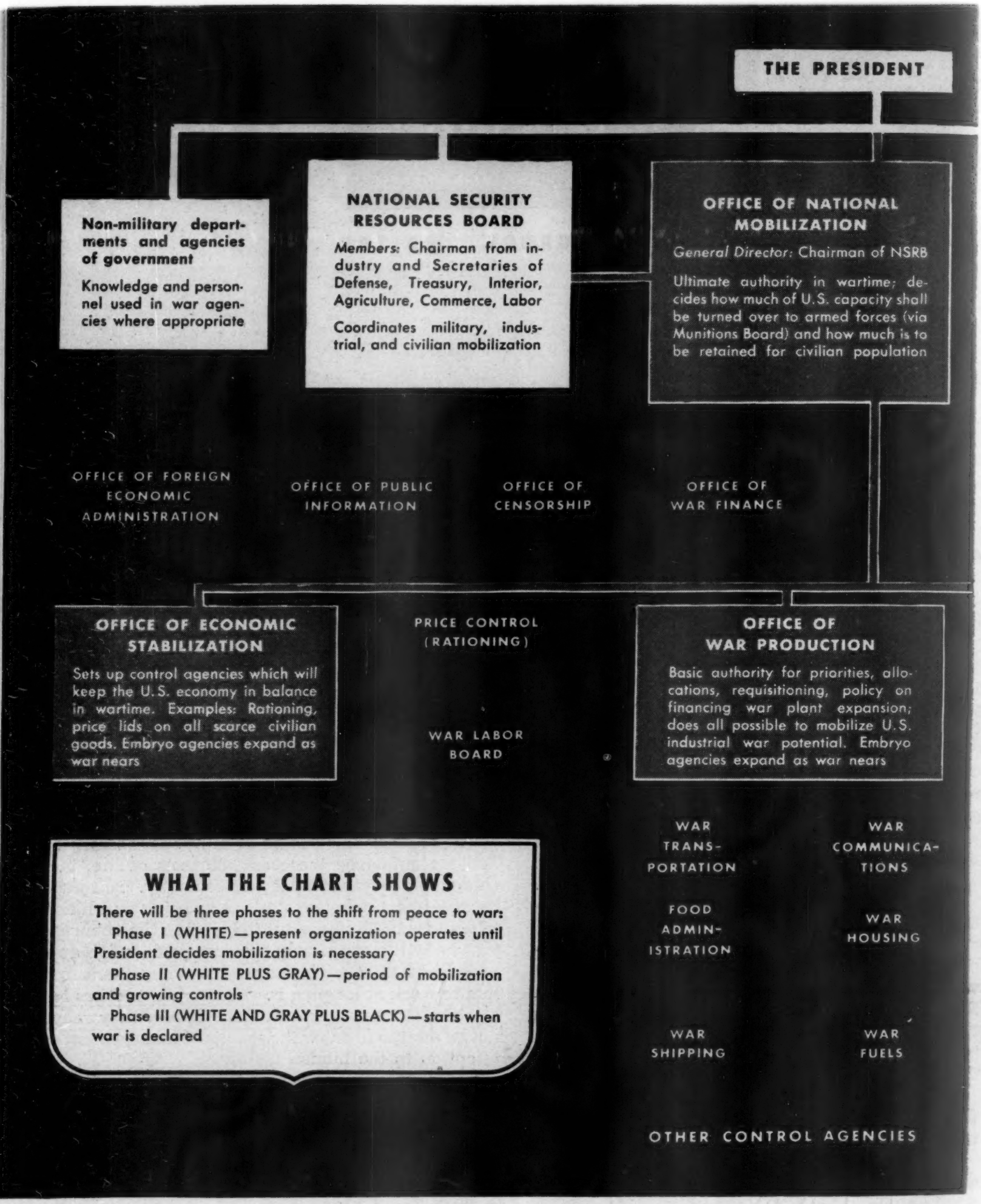
2. It is the company's customers who, collectively, are his boss. Their acceptances and rejections determine sales, determine prices, determine whether or not his company stays in business.

And another thing to be done by management: Tell the employee the economic facts of life, including the facts about his own company. Not just because the employee is a human being and likes to know such things. But to increase the chances that he will more nearly understand how it happens that he has a job and why it is important for him to work at keeping it. Unless the workers as a whole get that through their heads, they may not be around to enjoy the results of management's attention to the human factor.

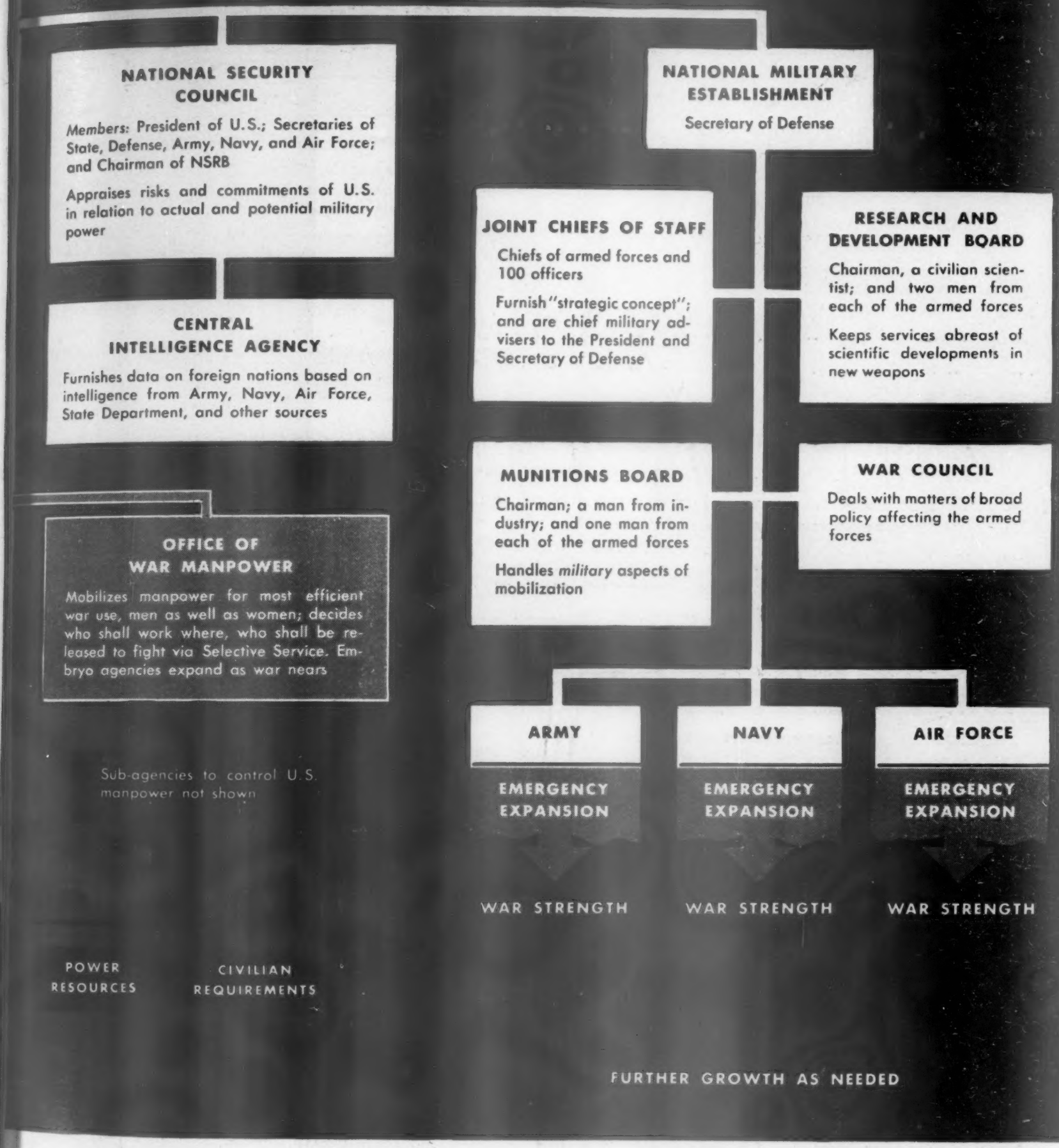
I have said nothing about indirect incentives. And there is much that could be said: The employee wants to be an individual. He wants to feel that he belongs. In a word, he wants recognition. To the extent that people who get up in meeting mean that we have a long way to go in that direction, I agree.

But on the whole, too many statements that are too broad are made. So I make this statement, itself probably too broad, to see if I can do something to keep us from going too far in the direction of believing that we don't consider the human factor in dealing with employees.

L. C. Morrow


THE PRESIDENT
Non-military departments and agencies of government
Knowledge and personnel used in war agencies where appropriate
NATIONAL SECURITY RESOURCES BOARD
Members: Chairman from industry and Secretaries of Defense, Treasury, Interior, Agriculture, Commerce, Labor
Coordinates military, industrial, and civilian mobilization
OFFICE OF NATIONAL MOBILIZATION
General Director: Chairman of NSRB
Ultimate authority in wartime; decides how much of U.S. capacity shall be turned over to armed forces (via Munitions Board) and how much is to be retained for civilian population
OFFICE OF FOREIGN ECONOMIC ADMINISTRATION
OFFICE OF PUBLIC INFORMATION
OFFICE OF CENSORSHIP
OFFICE OF WAR FINANCE
OFFICE OF ECONOMIC STABILIZATION
Sets up control agencies which will keep the U.S. economy in balance in wartime. Examples: Rationing, price lids on all scarce civilian goods. Embryo agencies expand as war nears
PRICE CONTROL (RATIONING)
WAR LABOR BOARD
OFFICE OF WAR PRODUCTION
Basic authority for priorities, allocations, requisitioning, policy on financing war plant expansion; does all possible to mobilize U.S. industrial war potential. Embryo agencies expand as war nears
WAR TRANSPORTATION
WAR COMMUNICATIONS
FOOD ADMINISTRATION
WAR HOUSING
WAR SHIPPING
WAR FUELS
OTHER CONTROL AGENCIES
WHAT THE CHART SHOWS
There will be three phases to the shift from peace to war:
Phase I (WHITE)—present organization operates until President decides mobilization is necessary
Phase II (WHITE PLUS GRAY)—period of mobilization and growing controls
Phase III (WHITE AND GRAY PLUS BLACK)—starts when war is declared

WHAT WE ARE DOING ABOUT NATIONAL SECURITY

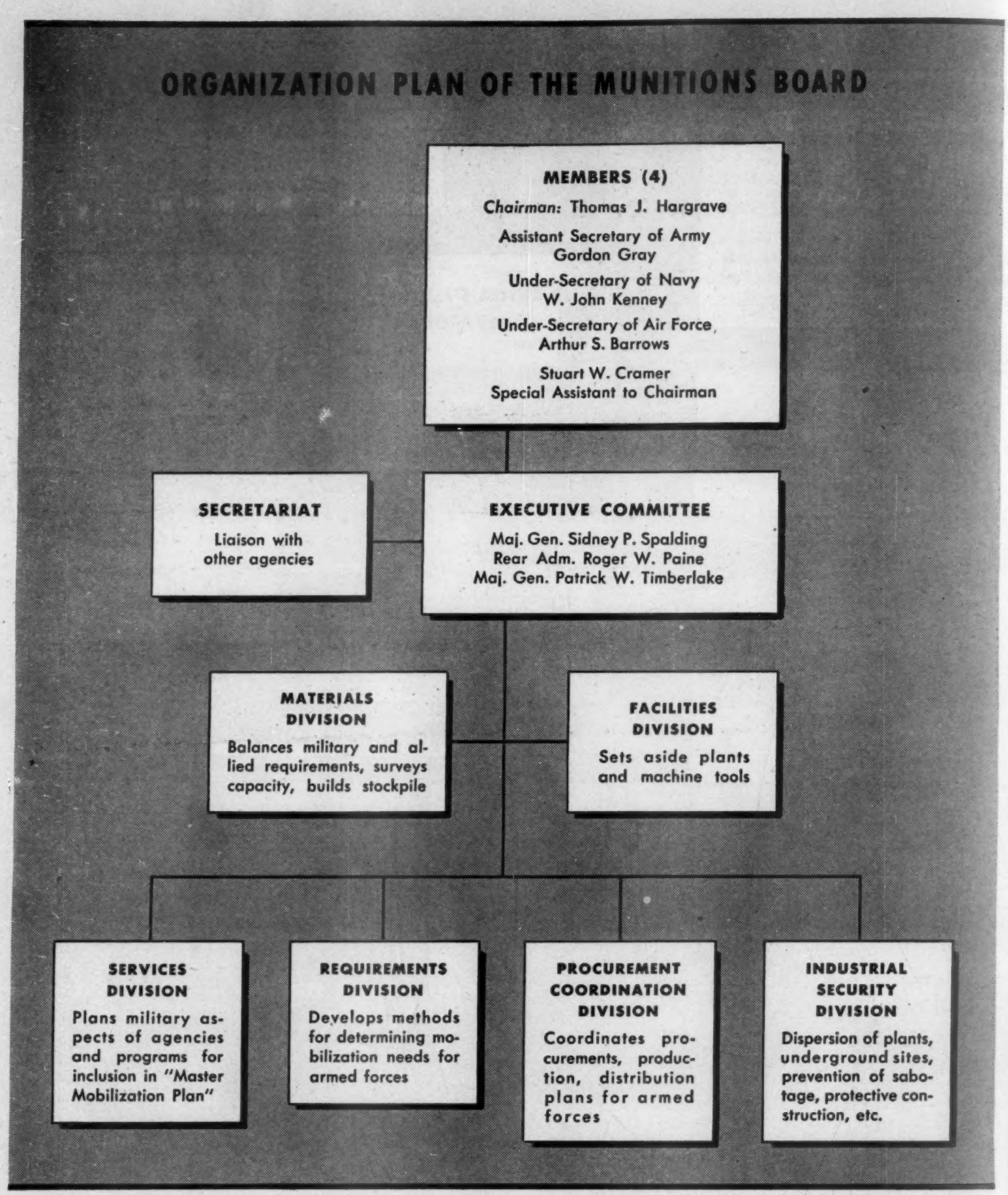

NATIONAL SECURITY COUNCIL
Members: President of U.S.; Secretaries of State, Defense, Army, Navy, and Air Force; and Chairman of NSRB
Appraises risks and commitments of U.S. in relation to actual and potential military power
CENTRAL INTELLIGENCE AGENCY
Furnishes data on foreign nations based on intelligence from Army, Navy, Air Force, State Department, and other sources
OFFICE OF WAR MANPOWER
Mobilizes manpower for most efficient war use, men as well as women; decides who shall work where, who shall be released to fight via Selective Service. Embryo agencies expand as war nears
Sub-agencies to control U.S. manpower not shown
NATIONAL MILITARY ESTABLISHMENT
Secretary of Defense
JOINT CHIEFS OF STAFF
Chiefs of armed forces and 100 officers
Furnish "strategic concept"; and are chief military advisers to the President and Secretary of Defense
RESEARCH AND DEVELOPMENT BOARD
Chairman, a civilian scientist; and two men from each of the armed forces
Keeps services abreast of scientific developments in new weapons
MUNITIONS BOARD
Chairman; a man from industry; and one man from each of the armed forces
Handles military aspects of mobilization
WAR COUNCIL
Deals with matters of broad policy affecting the armed forces
ARMY
NAVY
AIR FORCE
EMERGENCY EXPANSION
EMERGENCY EXPANSION
EMERGENCY EXPANSION
WAR STRENGTH
WAR STRENGTH
WAR STRENGTH
POWER RESOURCES
CIVILIAN REQUIREMENTS
FURTHER GROWTH AS NEEDED

Is industry prepared to fight another war? Can it, at a moment's notice, begin at a point it took two years to reach after World War II began? If it can, then the national security is assured.

It is now 2½ years since the war ended. Already events have convinced everybody that a third war is a possibility. Obviously the *nation* must be prepared. Hence *industry* must be ready to mobilize at a moment's notice.

Is there an industrial mobilization plan? Who made it? How good is it? Who runs it? How far along is it?

There *is* a plan (see chart above). It is called the 1947 Industrial Mobilization Plan. This plan is broad. It has to do with the entire economy of the United


ORGANIZATION PLAN OF THE MUNITIONS BOARD
MEMBERS (4)
Chairman: Thomas J. Hargrave
Assistant Secretary of Army
Gordon Gray
Under-Secretary of Navy
W. John Kenney
Under-Secretary of Air Force,
Arthur S. Barrows
Stuart W. Cramer
Special Assistant to Chairman
SECRETARIAT
Liaison with other agencies
EXECUTIVE COMMITTEE
Maj. Gen. Sidney P. Spalding
Rear Adm. Roger W. Paine
Maj. Gen. Patrick W. Timberlake
MATERIALS DIVISION
Balances military and allied requirements, surveys capacity, builds stockpile
FACILITIES DIVISION
Sets aside plants and machine tools
SERVICES DIVISION
Plans military aspects of agencies and programs for inclusion in "Master Mobilization Plan"
REQUIREMENTS DIVISION
Develops methods for determining mobilization needs for armed forces
PROCUREMENT COORDINATION DIVISION
Coordinates procurements, production, distribution plans for armed forces
INDUSTRIAL SECURITY DIVISION
Dispersion of plants, underground sites, prevention of sabotage, protective construction, etc.

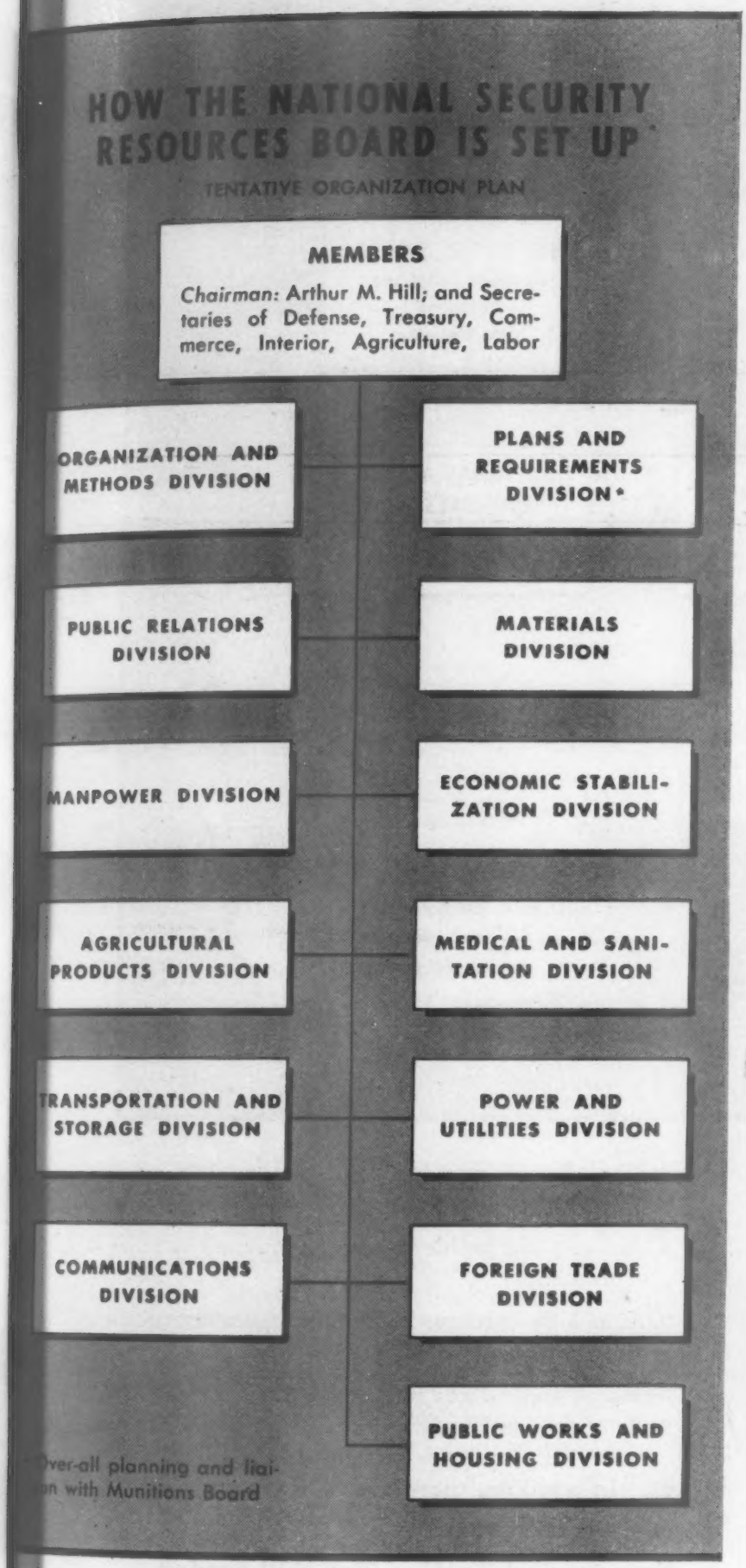
States during the period leading to war and then during the war itself. It suggests the government agencies that would regulate the lives of 140,000,000 people, and would govern business, industry, and every other pursuit under wartime conditions.

"This plan," the introduction states, "proposes to set forth, in support of military mobilization plans, a program for effective, efficient, and rapid marshaling of the nation's industrial and economic resources."

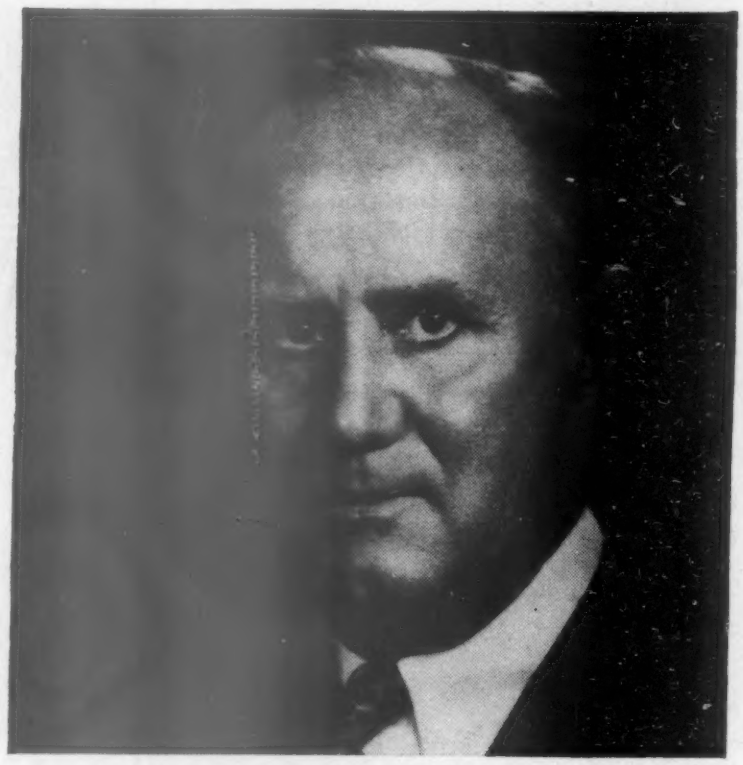
But the 1947 plan is far from complete. Deadline for the first comprehensive mobilization plan: Five years, possibly a little sooner. (Less complete plans are written annually.)

Cost over this initial period: $3.154 billion for a stockpile of strategic materials; more than $500 million for machine tool stockpile and storage; unspecified millions for research, administration, training, and other items.

Two federal agencies are responsible for specific phases of mobilization planning—the National Security


HOW THE NATIONAL SECURITY RESOURCES BOARD IS SET UP
TENTATIVE ORGANIZATION PLAN
MEMBERS
Chairman: Arthur M. Hill; and Secretaries of Defense, Treasury, Commerce, Interior, Agriculture, Labor
ORGANIZATION AND METHODS DIVISION
PLANS AND REQUIREMENTS DIVISION*
PUBLIC RELATIONS DIVISION
MATERIALS DIVISION
MANPOWER DIVISION
ECONOMIC STABILIZATION DIVISION
AGRICULTURAL PRODUCTS DIVISION
MEDICAL AND SANITATION DIVISION
TRANSPORTATION AND STORAGE DIVISION
POWER AND UTILITIES DIVISION
COMMUNICATIONS DIVISION
FOREIGN TRADE DIVISION
PUBLIC WORKS AND HOUSING DIVISION
Over-all planning and liaison with Munitions Board

ARTHUR M. HILL, chairman of the National Security Resources Board. From his agency would spring the Office of National Mobilization, "ultimate authority" in time of war



THOMAS J. HARGRAVE, chairman of the Munitions Board, plans *military* aspects of mobilization. In wartime, his group would form essential link between industry and armed forces

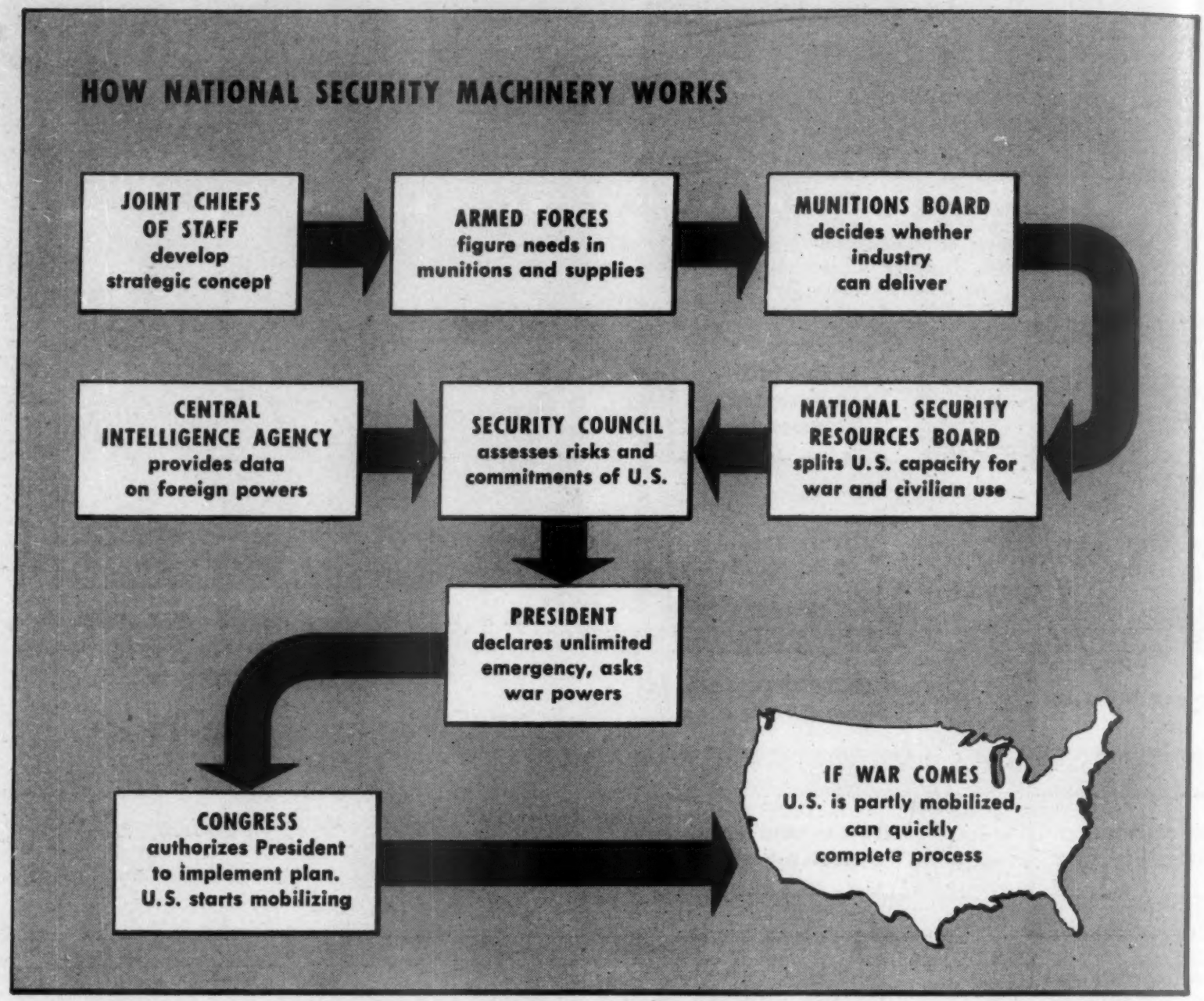
Resources Board and the Munitions Board. They stem from the National Security Act of 1947, which integrated the armed forces under a single head, the Secretary of Defense.

The Act also set up (or gave permanent status to) four other agencies whose sole purpose is to help the executive branch of the government carry out its responsibilities in the field of national security. They are National Security Council, War Council, Research and Development Board, Joint Chiefs of Staff. The relationship of these agencies to each other and to the program is shown in the chart on pages 66 and 67. Organization charts of the important Munitions and Resources Boards are shown above.

The Why and What of Mobilization

The Munitions Board wrote the 1947 plan. In doing so, it made basic assumptions:

1. The United States will "be among the initial combatants" if a war occurs within the next three


HOW NATIONAL SECURITY MACHINERY WORKS
JOINT CHIEFS OF STAFF develop strategic concept
ARMED FORCES figure needs in munitions and supplies
MUNITIONS BOARD decides whether industry can deliver
CENTRAL INTELLIGENCE AGENCY provides data on foreign powers
SECURITY COUNCIL assesses risks and commitments of U.S.
NATIONAL SECURITY RESOURCES BOARD splits U.S. capacity for war and civilian use
PRESIDENT declares unlimited emergency, asks war powers
CONGRESS authorizes President to implement plan. U.S. starts mobilizing
IF WAR COMES U.S. is partly mobilized, can quickly complete process

to five years, and will be "the object of attack at the outset of hostilities."

2. Some nations will support America while others remain neutral.

3. Rapid mobilization will be essential.

4. The present "high level of economic activity in the economy of the United States" will continue to the outbreak of war.

The plan then:

1. Proposes a mechanism to direct industry during the war.

2. Describes the principal wartime relationships between the military procurement agencies and their contractors.

3. Provides for the development of source information necessary for the effective application of resources in wartime.

4. Outlines a process by which military requirements of munitions can be estimated and tested in the light of capacity to produce them.

5. Considers the problems and techniques of military procurement.

6. Outlines the structure of control agencies essential for total mobilization.

A series of appendixes augments the general plan with texts of relevant legislation. It lists mobilization studies—96 in all—and presents charts of special committees. In addition, there are annexes to the plan which provide data on specific phases of mobilization.

How the Mobilization Plan Will Expand

The plan is presented in three time-phases (see pages 66 and 67). Phase I extends from the present time to the day "the President decides that mobilization is necessary." Phase II continues until Congress declares war. Phase III follows the declaration of war.

Almost nobody knows anything about the mobilization plan. Yet in the introduction to the plan this statement is made:

"To insure public acceptability of their product is a primary responsibility of the authors of a plan. Effectiveness of a plan is wholly conditioned by the terms the public considers essential. If an effective plan is

designed and presented for mature consideration, the public can draw the necessary conclusions as to the essentiality of its terms."

In the face of this statement, the 1947 plan has been a restricted document ever since its completion several months ago. A few copies have been circulated among top industrial leaders "for comment," but no effort is apparent to release details of the plan to the general public. FACTORY was able to secure a copy for examination but not for keeps.

How the Munitions Board Functions

The Munitions Board is charged with:

1. Building up a materials stockpile to a value of 3.154 billion.

2. Setting aside machine tools worth $500 million.

3. Coordinating procurement, production, and distribution plans for the Army, Navy, and Air Force.

4. Recommending procurement responsibilities among the armed forces.

5. Allocating the purchase of technical and commonly used items to one service.

6. Standardizing specifications among the three forces.

7. Determining relative priorities among the various procurement programs.

8. Preparing estimates of potential production, procurement, and personnel for use in the evaluation of the "logistic feasibility of strategic operations."

There are eight divisions of the Munitions Board: Secretariat, Materials, Requirements, Industrial Security, Services, Procurement Coordination, Facilities Survey.

At the head of the Munitions Board, as chairman, is Thomas J. Hargrave, president of Eastman Kodak Company. Other members are Assistant Secretary of the Army Gordon Gray, Under-Secretary of the Navy W. John Kenney, and Under-Secretary of the Air Force Arthur S. Barrows. Stuart W. Cramer is special assistant to the chairman.

The Board functions through an executive committee representing the three armed services and consists of Major General Sidney P. Spalding, Rear Admiral Roger W. Paine, and Major General Patrick W. Timberlake. Its job—to carry out the policies of the Board.

The Machinery Will Work Like This

Greatly simplified, here is the way this machinery is expected to work after the various units are running smoothly. From the Central Intelligence Agency (which reports to the National Security Council), from the State Department, and from other sources, information about foreign powers' war potentials, intentions, political ambitions, and other data are studied.

Country *X*, perhaps, shows up as a possible aggressor against the United States. While the State Department as "the first line of defense" intensifies American efforts to smooth out points of friction between the two nations, the Joint Chiefs of Staff draw up a "strategic concept" or revise one already written.

This concept indicates the broad military outlines to be followed in case of war with country *X*. The sizes and roles of the Army, Navy, and Air Force required to defeat the potential enemy are estimated, together with approximate quantities of munitions and supplies. Logistics are calculated, and a mass of other information is assembled.

The armed forces, in turn, base their manpower and materiel requirements on the strategic concept—stating not only *what* they will need but *when*—and at this stage the Munitions Board steps in. The demands of the services must be coordinated and geared to the available supply; procurement responsibilities must be worked out; procurement requirements—actual and potential—must be prepared.

The Part Played by the Resources Board

Working closely with the Munitions Board is the National Security Resources Board. Its responsibility is to coordinate military, industrial, and civilian mobilization and to develop plans which will assure its taking place rapidly and efficiently as necessity arises. The Resources Board divides the pie of total U. S. resources among the armed forces (via the Munitions Board) and the civilian population. It is the ultimate authority.

Chairman of the National Security Resources Board is Arthur M. Hill, a senior executive and a director of several Greyhound subsidiaries. The members of his board are the Secretaries of Defense, Treasury, Interior, Agriculture, Commerce, and Labor.

The current aim of the Board envisions a backbone of civil servants—the best available in 21 different fields—so that the work of the Board will have continuity, led by men "of outstanding capabilities from private life . . . on a rotating basis."

It is the hope of the chairman that industry will lend its junior executives to the Resources Board in peacetime for mobilization planning just as it lent its top executives to help prosecute the war. He has set six months as the time an executive should spend on this work.

Here Is Where We Stand Today

So much for a report on the plan and the two principal agencies charged with implementing it. Now for what things add up to today.

In the case of the National Security Resources Board, which is charged with the "coordination of military, industrial, and civilian mobilization," most of the work still has to be done. The machinery is there, ready for use, but it will take a corps of skilled managers—the younger men of business and industry—to come in and operate it. Whether industry will release this skill, via short-term loans of executives to work in Washington, is problematical.

The Munitions Board, legislative descendant of the old Army-Navy Munitions Board, smoothly assumed the new powers with which the National Security Act of 1947 endowed it and is plugging ahead today as a well-organized unit. The bulk of its work with indus-

try can be performed on the advisory committee level, outside Washington and usually at a place convenient to the industry concerned.

The Munitions Board is surveying every plant that filled contracts during the last war to make sure they will be properly allocated in any future war.

More than 6000 plants have already been tentatively allocated and the Board is processing applications of the armed forces for about 16,000 others. Close liaison is established between company and the selected service branch.

Plants and equipment are being set aside. According to the chairman of the Munitions Board, "During the last war the government built about 1200 new plants at a cost of around $14 billion. In addition, it spent in expansion of plants and facilities about $4 billion. Private industry expended about $5 billion more for new plants and expansion.

"It is hoped that the armed services will be able to retain about 120 of these specialized munitions plants, originally costing about $2.7 billion. It is expected that a sufficient number of them can be leased—at a rental in some instances of not more than cost of maintenance—so that the cost to the taxpayers of such government ownership will be small."

The War Assets Administration, meanwhile, is attempting to sell or rent 177 other munitions plants under a national security clause. This would make the properties immediately available in case of emergency.

Machine tools to be installed in these plants are being laid away, between 60,000 and 70,000 to date. (Target: 92,000). This reserve, authorized by Public Law 364, is valued at $500 million.

Materials studies have been undertaken. Only three have been completed—those on rubber, stockpiling, and a European Aid Program. Objectives of a materials study are inventory of potential supply; a comparison of that inventory with estimated requirements; determination of what steps must be taken to overcome foreseeable shortages.

Manpower Studies Under Way

As to manpower, substantial work has been done. Before the Resources Board was created, the old Army-Navy Munitions Board had initiated studies which are being completed by the Resources Board, as a result of taking over the lion's share of the manpower field.

However, a great deal more research must be completed before a definitive plan can be written which will use American manpower to the best advantage in wartime. To this end, a labor committee is currently studying the problem for the Resources Board. The Munitions Board has tackled the other end of the problem—reserves for the three armed forces.

Tied into this work are wartime controls for prices, rationing, profits, flow of materials, elimination of non-essential production, and so on. Each case will need to be analyzed with a view to working sub-plans into the master mobilization program and integrating the whole. No great progress has been made.

On the military side of industrial mobilization, the Industrial College of the Armed Forces has been plugging away since 1920 and has made some notable contributions. It was this college which developed the first major plan for industrial mobilization more than 15 years ago, and helped materially in preparing the revision of 1939—the so-called Johnson Plan.

The college's mission is to train handpicked groups of officers for high command posts "in all aspects of mobilization of the national economy, economic warfare, procurement planning, and procurement." Its graduates include a number of the top officers of World War II, from Eisenhower on down. As a school which ranks with the Army War College (they share facilities), the pace is fast, the courses are demanding. Part of the curriculum includes shirt-sleeves-and-overalls studies at basic types of factories, an experience considered essential by the commandant, Brigadier General E. B. McKinley. But the college is too small. Total enrollment is only 115 officers per year, split among Army, Navy, and Air Force. Not enough officers can be trained to fill all the posts a war creates. Lack of funds prevents expansion.

What Progress in Stockpiling?

There is marked difference of opinion as to progress made in stockpiling. The National Security Resources Board sets the general policy in regard to administering the Stockpiling Act (Public Law 520); the Munitions Board does the actual purchasing. Policies adopted and progress made are set forth on page 73.

There Is Still a Long, Long Way to Go

The Industrial Mobilization Plan is a promising start. Already an impressive amount of work has been poured into it—sifting the experience of World War II, probing weaknesses in the last mobilization effort, conducting exhaustive studies to make the post-war program more effective.

More machinery than ever before has been created, most of it well designed.

Plenty of spadework has been done. Part of the foundation, but little of the mobilization structure itself, has been erected.

A vast amount of hard-headed planning has been done by the best brains private business and industry can provide.

A long-term training program embracing industry, the armed forces, and certain government agencies, to familiarize each with the other's problems, potentialities, methods, and limitations has been set up. As much research and as many educational orders as the Congress will pay for, have been started.

The United States must be able to mobilize rapidly or it may never get the chance to mobilize at all. Only by advance planning can this be achieved. Moreover, no matter how able such planning is, it remains (in this country) merely a collection of pretty charts and paper unless:

1. American citizens are familiar with the underlying principles and have become willing to back them.

2. Legislation has been passed which will enable the plan to start rolling early—at the order of Congress or the President.

Neither is being attempted. No genuine effort has been made to date—or is forecast for the near future. It takes years, not months, to inform the general public on a complex matter like mobilization planning. The planners well know this, if the text of the Industrial Mobilization Plan is any indication. This lesson should have been learned from the experience prior to World War II with the Johnson Plan. The public simply didn't know what the mobilization plan was all about. Congress didn't know. Result: The plan was shelved.

Things finally reached the point where, quietly and without fanfare, the main principles of the Johnson Plan were lifted out and meshed into the government's war effort. By 1943, a considerable number of ideas and techniques were in use and, furthermore, found to be most effective.

That was part of the story. The other chapter centered around the difficulty of getting needed legislation through Congress as the time for mobilization approached, arrived, and passed. The recent testimony of Johnson, Baruch, Nelson, Ferdinand Eberstadt, and others who participated in the war effort at the control level is very plain. Congress became shy of any action which might conceivably strain U. S. foreign relations. Political expediency dictated a policy of buckpassing and the nation paid later.

There is only one other answer. The basic legislation must be passed now or in the near future. It will take time to thrash it out; it will be hotly debated all over the country. But it needs to be placed "on ice" to avoid being defeated by the strange waywardness that seems to overtake Congress when it approaches the question in a period of emergency.

The lessons are clear. They were dearly bought in two world wars. In the next one—if it comes—America must profit by them—or risk annihilation.

STOCKPILING PROGRAM IS GOING AHEAD, BUT TOO SLOWLY

● Definition: "Strategic and critical materials are those required for essential uses in a war emergency, the procurement of which in adequate quantities, quality, and time is sufficiently uncertain for any reason to require prior provision for the supply thereof." There are 105 items on three lists which are constantly being revised.

In stockpiling, there is danger of competing for materials of which industry is still short. Indiscriminate buying would hamper the domestic economy and drive up prices in markets already inflated.

But no agency can assume the responsibility for holding off purchases to the point that the nation's stockpile would wind up shy in 1951, provided sufficient funds had been made available in the meantime. A go-slow policy is in effect:

1. Buy whatever materials are "most lacking" without interfering with industry's needs.
2. Pay no more than market prices, get it for less if possible, "unless [the item] is far behind the required acquisition schedule."
3. Avoid spending available funds too rapidly.

In dollars and cents, here is the way the stockpile looked at the beginning of 1948:

1951 Goal—a stockpile of critical materials worth	$3,154,000,000
Less—value of items still on hand from war stockpile (Public Law 117)	81,000,000
Less—value of surplus property acquisitions estimated to be worth	316,000,000
To be purchased over five years	***$2,757,000,000***

To achieve this $2.7 billion goal in five years would require a spending program averaging about $550 million annually. So far, however, funds have been granted which total only $275 million for two of these five years, 1947 and 1948. Where stockpiling is concerned, the Congress has been economy-minded and the Munitions Board, following its go-slow policy, has hewn to the line that "tight" materials can be bought up later—and therefore has not really turned the heat on to get larger appropriations.

At the end of last year, the attitude of the Munitions Board changed somewhat. Its off-the-record request to Congress for fiscal 1949 was $435 million for stockpiling. Before this item reached the House, however, it had been badly slashed and stands currently at $285 million.

The maximum amount of money which the Munitions Board can possibly spend in three of the five fiscal years, therefore, amounts to only $560 million, just over the sum planned for one year.

Despite all these difficulties, the stockpile has grown to substantial proportions. Materials are stored at 55 military reservations, according to the Munitions Board's latest report. They occupy 6 million square feet of open storage and 2 million square feet in warehouses. Only a few items need to be rotated (to prevent deterioration), and this is being done.

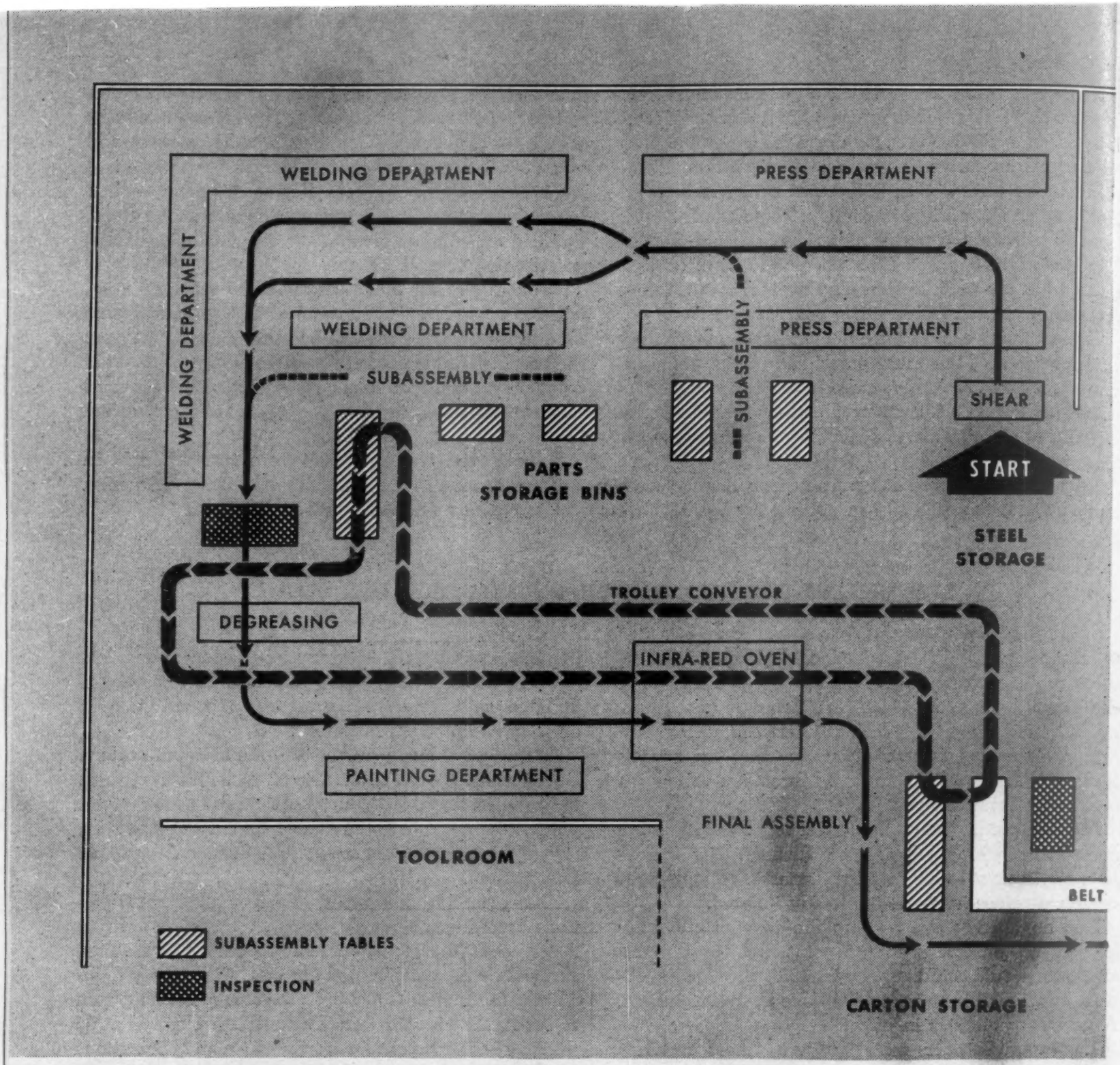
In a word, stockpiling is going ahead, but much too slowly. The letter and spirit of the law are being carried out. But the law needs changing. The government's policy of "hands off stockpile materials in short supply"—as an aid to speeding reconversion of industry—has served the country well. Certainly large-scale buying during the past two years would have had dangerous repercussions on the nation's economy.

This year, however, a new policy should be adopted permitting:

1. Larger purchases, even if private interests complain. The nation comes first.

2. Monetary (and perhaps technical) help to step up production at home and abroad of certain materials that continue in tight supply.

This course is not cheap or easy. But it will build the stockpile.



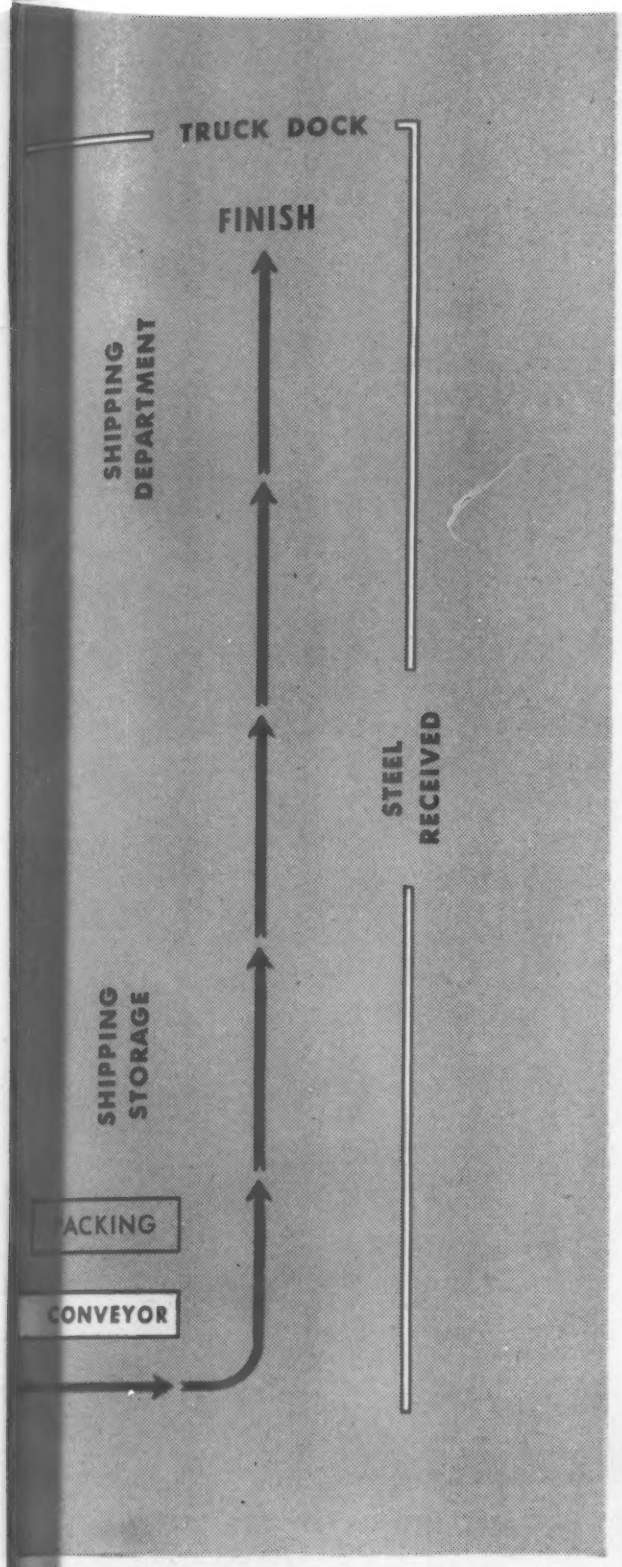
FLOW CHART OF DOEPKE COMPANY ASSEMBLY LINE, WHICH CAN EASILY BE SWITCHED FROM ONE PRODUCT TO ANOTHER

MULTI-PRODUCT ASSEMBLY ON A SINGLE LINE

Straight-line flow is arranged for quick change-over so that any of three products can be made on the same line

STRAIGHT-LINE manufacture—with three widely different products turned out on the same line. That is the cost-production formula currently being used by Charles Wm. Doepke Company, Rossmoyne, Ohio.

The layout is designed for production of the four current models of construction toys—bucket loader, dump trucks, road grader, and cement mixer. The problem arose from the fact that the present market for these toys does not justify a continuously operating production line for each. The three-purpose line was the answer. Production experience has demonstrated that it is most economical to manufacture units on a monthly schedule basis. It has been found that this not only results in lower unit cost, but also, in the long run, results in a higher



AND IS, ABOUT ONCE EVERY MONTH

production volume from the same equipment.

This does not mean that every department is changed over from one toy to another on the first of each month. But it does mean that each department in the plant works for one month on the manufacture of parts or assemblies for one particular line of toys.

Actually, the press department change-over is scheduled about two weeks ahead of the welding department change-over. This procedure allows a satisfactory backlog of parts which permits the welding department to swing into production on a full-time basis. In the rest of the departments, the change-over is relatively quick; little or no time interval is involved.

Models are constructed from cold-rolled sheet and strip stock. In the press department, hand-forming presses perform various wire-bending and hand-forming operations, thus relieving the larger presses. After the parts are stamped out, they must all be tumbled to remove burrs that might cut or scratch children.

Toys Are Welded

Resistance welders are employed almost exclusively in the fabrication of parts into subassemblies, and the subassemblies into completed assemblies. The toys contain an average of about 70 parts and require about 150 welds per toy. The steel rods that serve as seat racks, latches, axles, and cranks are formed and crimped on pneumatically operated tools using specially designed dies.

After being inspected for weld failures and possible misalignment, the toys are hung on an overhead conveyor, removed for degreasing, rehung on the conveyor, which takes them to the paint department.

Depending on the construction of the toy and the color desired, the toys are either dipped or spray painted and baked at a temperature of 350 deg. F. for six minutes in electric infra-red ovens.

When they emerge from the oven, the toys are taken off the conveyor and carefully inspected for operating characteristics as well as quality of paint.

They are then placed on a belt conveyor where the final fitting out takes place. In the case of the bucket loader, the bucket chain is threaded onto the toys, the track assembly is attached, and the drive chain is added.

On the wheeled toys, the tires are put on and the decals applied. This assembly line is entirely hand work. The use of machines would mar the finish.

Ride Belt Conveyor

After the last operation, the toys are again placed on a belt conveyor, where they are given a final inspection and break-in. This latter insures that all parts are in perfect working order.

Following inspection, the toys are individually packaged in cartons, and delivered to the shipping area.

TROLLEY CONVEYOR (background) carries toys through degreasing, painting, and drying operations. For final fitting out, they ride a belt conveyor (foreground)

MATERIALS FOR PLANT UPKEEP ARE ALWAYS AT HAND

ALL STOCKROOM RECORDS ARE KEPT ENTIRELY BY TWO CLERKS

GOOD PRACTICE IN A MAINTENANCE

Should plant maintenance have its own stockroom? Can all purchases and disbursements be properly accounted for? How is excessive stockpiling avoided? Answers to these and many other questions are found in this two-part article

JOSEPH HENDERSON • ASSISTANT MANAGER, PLANT SERVICE DEPARTMENT THOMAS A. EDISON INC., WEST ORANGE, N. J.

THOUSANDS of dollars are being saved annually by Edison's centralized maintenance stockroom. These savings are more than justifying the operating cost of a stockroom personnel of two bookkeepers, two stock clerks, one general storekeeper, and an assistant.

To realize how and why, let's look at the major benefits. Costwise, here is what the maintenance stockroom is doing:

1. By keeping on hand adequate stock of the right kind, or getting prompt delivery by purchase, it (a) minimizes delays on maintenance work orders; (b) minimizes time lost on breakdowns; (c) increases maintenance efficiency.

2. By keeping careful records of all transactions, it (a) eliminates waste of maintenance materials; (b) salvages left-over materials ordered for specific jobs; (c) keeps

SO STOCKMEN IN ADJACENT ROOM CAN CONCENTRATE ON STOREKEEPING DUTIES

STOCKROOM

down the inventory on parts and supplies.

These general pursuits encompass numerous opportunities for savings in labor and materials production-wise as well as in cost of maintenance. In addition, accurate and reliable costs are obtained on every maintenance job.

Strict Control Practiced

All materials required for the maintenance of Edison's main West Orange plant and a nearby Silver Lake plant clear through the centralized maintenance stockroom. These two plants house eight major manufacturing divisions which occupy about 1⅓ million square feet of floor space. All buildings and general plant services are maintained by a plant service department which has over 80 craftsmen and 8 janitors. Also, each of the eight divisions has its own specific maintenance staff and area mechanics, totaling about 100 more men. These 188 maintenance men get all supplies, repair parts, and tools from the one maintenance stockroom. This stockroom operates independently of stockrooms for raw materials used in manufacturing or processing.

Fundamentally, basis for all activities of this stockroom is the exercise of a strict control over all maintenance materials. This positive control begins from the time the material is ordered, it continues through its receipt, storage, and disbursement, and ends with a full accounting of its disposition. Considerable paperwork is involved, but it's paperwork that pays and gets results, and not red tape.

How System Operates

A description of the operations of the maintenance stockroom readily divides itself into consideration of five main problems:

1. What personnel is needed?
2. How many items of stock must be carried, and how much?
3. How is the material received and disbursed?
4. What records and paperwork are necessary for good control?
5. What is the best physical set-up for material storage?

These questions will be answered in the following text either by statements of the principles established or by their actual applications in this plant. The methods used represent the development of practices through many years of experience. They have proved their value in dollars and cents.

1. Personnel. The number and duties of the stockroom staff have already been mentioned. The two female bookkeepers occupy space with the general storekeeper and his assistant in an office adjoining the stockroom. Inventory records are maintained and costs are calculated by bookkeeping machines.

The general storekeeper, who is in charge, reports to the division manager of the plant service department. All maintenance materials are purchased by the general purchasing department, and are charged to the stockroom. Each month the stockroom is credited by the accounting department with all receipts. It is debited for disbursements through a recapitulation of material charged to shop orders

issued by all divisions. An annual inventory of stock is checked against a control account in the accounting department, and variances are investigated. These controls effectively plug all possibilities for leaks of stock to illegitimate uses.

2. Stock. What to stock has been dictated as to kind by experience and as to quantity by close control. Six main kinds of supplies involving about 2320 items are carried in stock. There are about 500 items of hardware, 690 items of steam and pipe fittings, and 400 items of electrical supplies. Boiler house supplies (600 items), painters' supplies (50 items), and safety equipment (80 items) constitute the balance.

Close control that is made possible by a perpetual inventory system allows a minimum and maximum of 1 and 3 months' supply on individual items. In a typical year the annual inventory was kept down to $30,000 with a turnover of more than twice that amount.

Obsolescence is guarded against by keeping the stock inventory as low as possible. Maximums and minimums are being revised constantly by checking the previous 6-months' consumption at the time of each re-order. This is reduced to a 3-months' basis as maximum. Also, on large shop orders foremen estimate their material requirements and issue a purchase request to the stockroom to cover. In the meantime they may draw on stock to start the job, if necessary, and pay it back when their material arrives. This makes it unnecessary to keep large amounts on hand. Unused standard items are returned to the stockroom for credit.

Standardization practices also minimize obsolescence. Any departure from standard items on a purchase request must be signed by a foreman. Unused special items are returned to the stockroom but remain charged to the job for which ordered. If used later, the job is credited, but the stockroom never carries the charge. This insures care in ordering special equipment.

3. Receipts and disbursements. Almost all materials are delivered directly to the maintenance stockroom. There would be no exceptions to this at all but for the fact some parcel post and express shipments require charges to be paid. Hence all such shipments (about 5 per cent) clear first through the general receiving department which receives all raw and prefabricated materials for the plant.

To conform with the company's receiving routine, the maintenance stockroom always makes out a temporary receipt for material it receives, pending the arrival of a regular permanent receipt from the general receiving department. This regular receipt is issued whenever this department in turn receives a vendor's delivery ticket from the stockroom. The stockroom alone is responsible for checking quantities and specifications. These arrangements answer all justified criticisms relative to the unwisdom of letting a maintenance department receive its own material, or to the inability of a clerk to check receipts.

Materials purchased as supplies for the stockroom are placed in stock and entered on the perpetual inventory records. Materials purchased for definite jobs do not clear through the perpetual inventory. They are either delivered directly to the jobs, or earmarked and held in the stockroom until the foremen are ready for them.

No Duplicate Records

Disposition of incoming material is determined by information on the stockroom copy of the purchase order. No material is received or unloaded without prior reference to the purchase order. All bin locations are marked on the perpetual inventory. To avoid needless duplication there are no bin records in the stockroom area. Bin locations can be checked by stock clerks by inquiry to the bookkeepers, which is rarely necessary. Since the stock clerks mark bin locations on all tickets for incoming or outgoing materials, a complete check is afforded.

All disbursements of supplies are made right from the stockroom, which is located in the same building as the general maintenance shops. No deliveries are attempted. Maintenance men are responsible for transport of materials from stockroom to the job.

Written material requisitions are honored when signed by any maintenance man. He need lose no time hunting around for a foreman's signature. Later on, however, such requisitions are approved by the foremen who come into the stockroom when convenient to review them. This serves to control excessive withdrawals.

(The second part of this article will appear in an early issue.)

MAINTENANCE MEN draw materials on their own requisitions. Stockman checks with his list of job numbers. No time lost getting foreman's approval, which is confirmed later

MORE THAN 600 OF FULTON'S 2300 EMPLOYEES HAVE BEEN TO SEE THE PODIATRIST AT THE COMPANY'S FREE FOOT CLINIC

FOOT CLINIC KEEPS WORKERS ON THEIR FEET

Georgia mill combats shuffling feet, lowers absenteeism better than 10 per cent, reports higher output per man-hour

TROY B. STONE • PERSONNEL DIRECTOR, FULTON BAG & COTTON MILLS, ATLANTA

EARLY last spring, a group of employees at Fulton Mills came off shift looking dead tired. They didn't walk. They shuffled. And they seemed to favor their feet.

Next morning the same group was observed again. A night's rest had made a big change. The shuffle had gone. The pace was alert. Here, obviously, was something well worth investigation.

It turned out to be sore feet. Management acted promptly and set up a free clinic with a podiatrist in charge as part of the company's medical and dental program.

The foot clinic was an immediate success from every point of view and so far, since its establishment last March, more than 600 of Fulton's 2300 employees have been treated. A good many workers come back again and again. Treatments to date include 79 nail diseases, 31 infections, 52 ingrowing toenails, 385 cases of athlete's foot, 101 callouses, 32 corns, 84 arch treatments, 31 warts, 32 growths, 16 general diseases, and 11 enlarged nails. Popularity of the service has led the company to a recent decision to extend its benefits to the families of all employees at an early date.

On the other hand, the company's expense ($3000 for equipment plus retaining fees) has been amply repaid in declining absenteeism and improved worker production. Foremen and overseers were soon able to report higher production and better morale, and credited the clinic with the change. Absenteeism, at the same time, dropped between 10 and 12 per cent. To Fulton management, the foot clinic has proved its worth as an important part of the employee health program. As such, it is sound industrial relations.

AMERICAN CENTRAL WORKERS REGISTER THEIR FEELINGS ABOUT TAFT-HARTLEY ACT IN A JOINTLY SUPERVISED ELECTION

GIVING LABOR-LAW

Here is a successful technique any plant can use to present basic legislative or economic information to employees

WILLIAM S. WHEELER • FIELD EDITOR, *FACTORY*, CHICAGO

How much can one man do in the space of three days to change the opinion of his employees regarding the Taft-Hartley Act? Eric O. Johnson, general manager of the American Central Division of the Avco Manufacturing Corporation, decided to find out. The result of Johnson's efforts are not just somebody's guess. They can be measured in unimpeachable secret ballots.

Employees at American Central were asked point-blank how they felt about the Taft-Hartley Act. They voted as they entered a meeting where Johnson explained the provisions of the law. They voted again as they came away from the meeting. Balloting was under strict joint supervision by officers of the company and the union (Local 151 UAW-CIO). Supervisory and non-supervisory employees cast their votes separately.

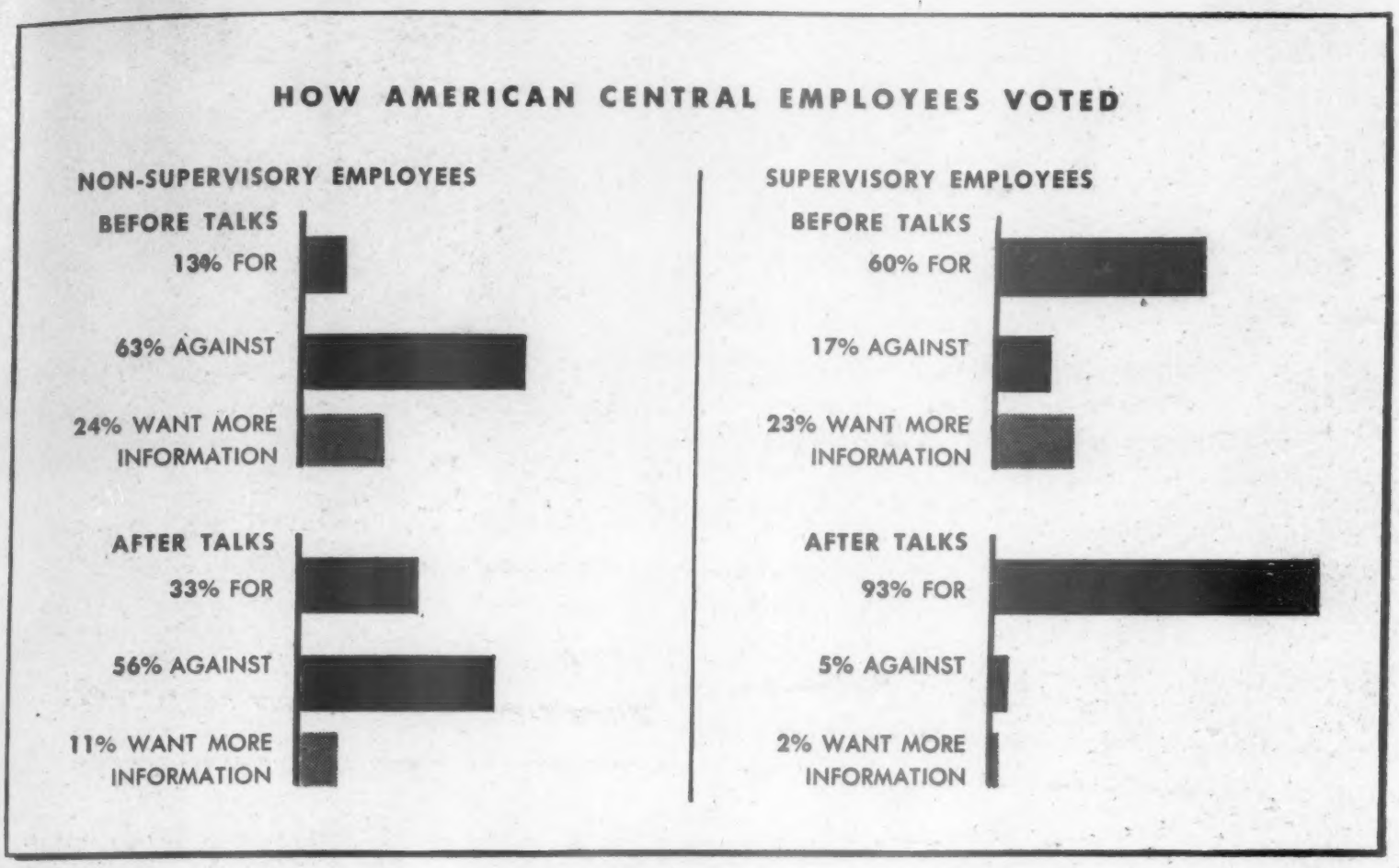
The complete results of this poll are shown in the table on the facing page. *The significant point is that after the meeting an additional 20 per cent of the workers voted in favor of the Act.*

There is no evidence here of any "miraculous reformation," but the figures do point to the heartening fact that during these brief meetings some 500 of American Central's 2500 employees took a long step forward.

A Simple Technique

The basic method of attack was not completely untried by American Central. Long convinced that employees are entitled to a full accounting of company facts and information, last year American Central undertook to impart this information through the medium of personal meetings between management and relatively small (100-150) employees (see FACTORY, October, 1947, page 100). The same approach was used in explaining the Taft-Hartley Act. Fifteen meetings were scheduled during the three-day period. Johnson's presentation was not simply a dry recital of the facts about the Taft-Hartley Law. After a brief introduction, an off-stage "voice" spoke up to challenge statements about the law. Here is how it worked:

Johnson: "Management must still bargain with the union chosen by you. Management still can't 'interfere with, restrain, or coerce its workers.' Management can still be punished for unfair labor practices. Labor's gains are fully preserved."



DIFFERENCES IN OPINION EXPRESSED BEFORE AND AFTER HEARING A TALK ABOUT THE ACT BY COMPANY OFFICIALS

FACTS TO WORKERS

Voice: "Well, I've heard that it's a slave labor law! How about that?"

Johnson: "There's a reason you've heard that—but it's not what you think.

"There was a time when the working man was almost a slave to his employer. I know—because I worked in such a shop myself. The Wagner Act gave the working man more collective power than ever before, and you've just heard that the Wagner Act is unchanged.

"But things went too far the other way. The rank-and-file union member, in many unions, became as much a slave to the wrong kind of union leader as he ever was to the wrong kind of employer.

"The Taft-Hartley Act attempts to set you, the worker, back on your feet as an individual and give you more freedom to decide things for yourself.

"Under this new law you get certain rights and privileges which you never had before. Let's take a look at them."

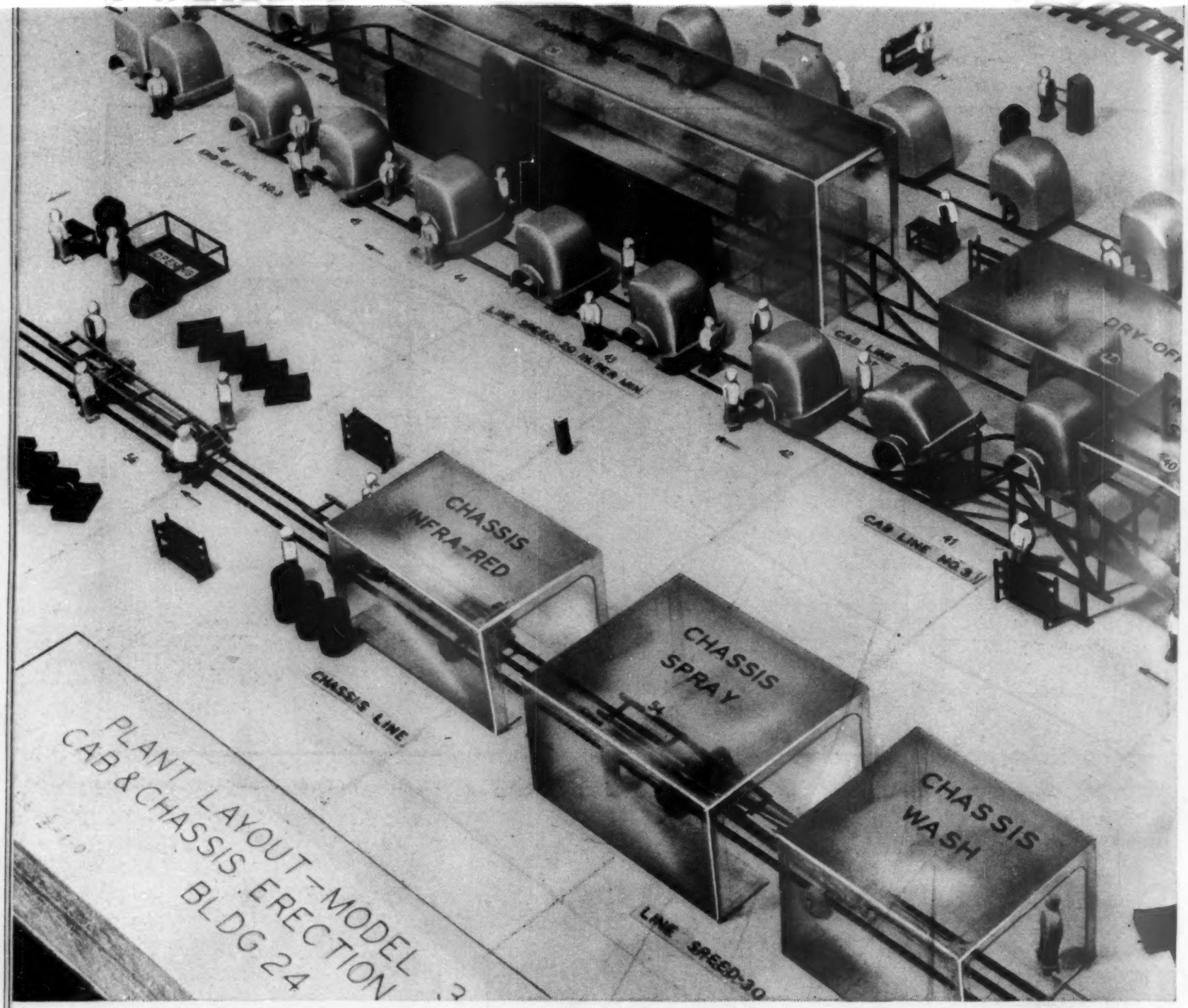
At a later point in the presentation, the worker-audience was asked, *"Do you know what you want?"* The answer was provided by an off-stage chorus of voices. The first answer given, for example, was, "We want peaceful settlement of disputes; differences worked out around the bargaining table without loss of wages." Taking up this challenge, it was immediately pointed out that, "the new law provides a 60-day period after a strike notice is filed, so that differences can be settled without the need for going on strike."

When this had been repeated through eight separate "demands" by the off-stage chorus, the first "voice" broke in again to say "Mr. Johnson, you can't take us in with that bunch of stooges. Maybe we want those things—maybe we don't. How the hell do you know what we want?"

For an answer to that, Johnson cited the results of the worker opinion poll published in *Look* magazine last fall, which showed a majority of workers in favor of all ten of the principal provisions of the Taft-Hartley Law. (For more detailed analyses of worker reaction to labor law provision, see FACTORY, July, 1946; June and November, 1947).

After the series of meetings concluded, the presentation was prepared in booklet form and distributed to all employees. The cover of the pamphlet bore this sentence from Johnson:

"Here is your copy of the talk . . . on the Taft-Hartley Law. I am sending you this so that you can study my remarks at your leisure. Remember, this is my personal feeling about the new law. Your final decision is strictly up to you. This booklet, like our meeting, is dedicated to our future, based on mutual respect, cooperation, confidence, and understanding."



THREE-DIMENSIONAL LAYOUT removed the guesswork when White methods men planned their company's new truck assembly line. Cab assembly starts at far right, doubles back through bonderizing and dry-off operations (in transparent plastic en-

SCALE MODEL LAYOUT PREVENTS

One scale model layout is worth 100 blueprints, in the opinion of the management of White Motor Company

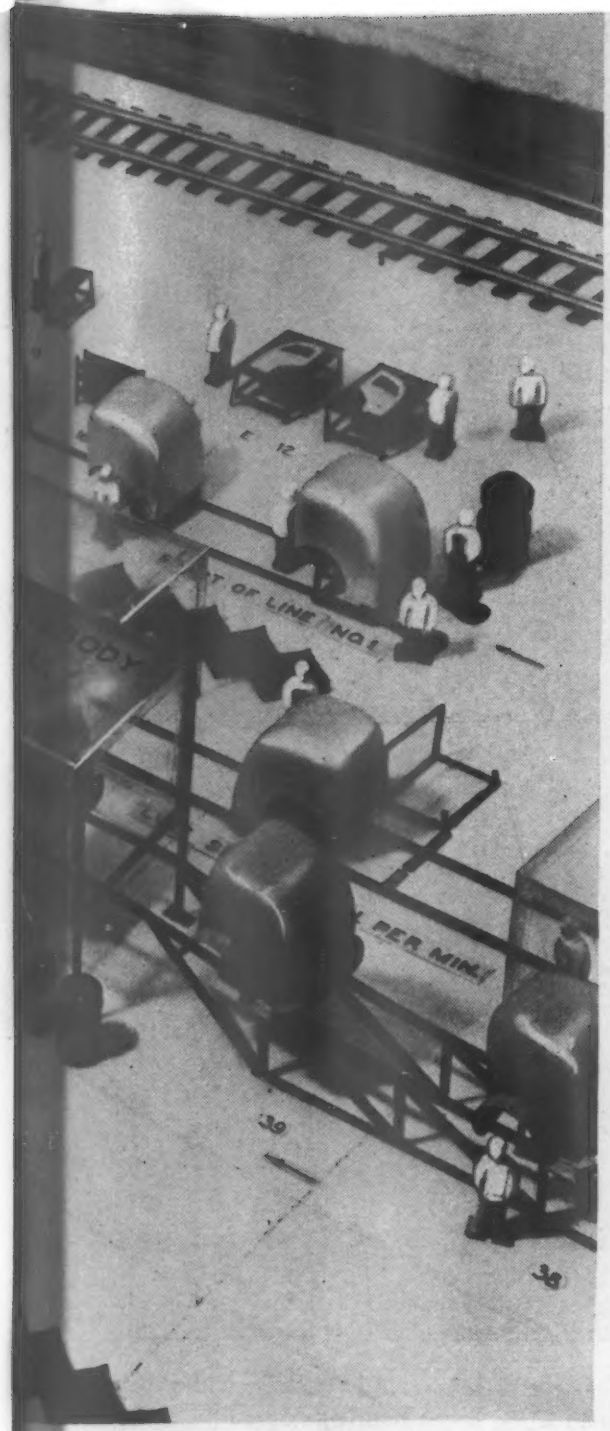
A RECENT problem involving a new layout for a truck assembly line was successfully solved by this Cleveland company with a scale model that included production equipment, building characteristics, and workers. Use of the model has (1) helped prove the accuracy of cost estimates before actual installation; (2) reduced to the minimum routing time and possible errors; (3) assisted in making detail drawings, assembly lists, and bills of material.

Net result of this enterprise is complete assurance that the assembly line will be free from the customary bugs when it is actually set up and put into operation.

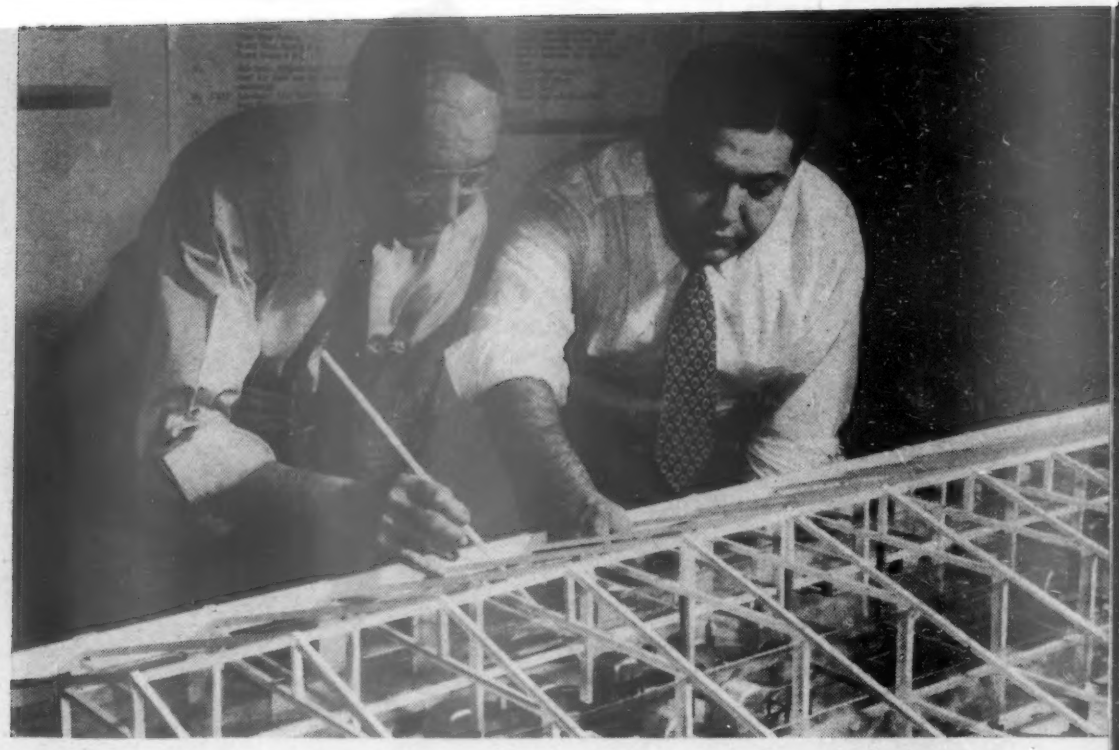
Looking to the Future

The model is constructed to a scale of ¼ inch equals 1 foot, and is a preliminary step toward a production line for a future series of White trucks. Patterned for an existing building, the relative sizes, distances, and heights of equipment, and the area occupied, are accurately revealed. The details are so fine that even tools and drinking fountains have been included in the model. Extensive use has been made of transparent plastic; it is thus possible for planners to visualize the actual flow of production through bonderizing, spray painting, and infra-red drying.

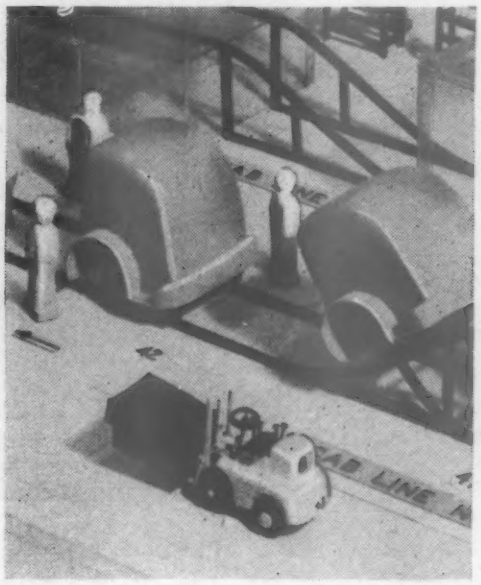
It took only six weeks to construct the model, but preliminary

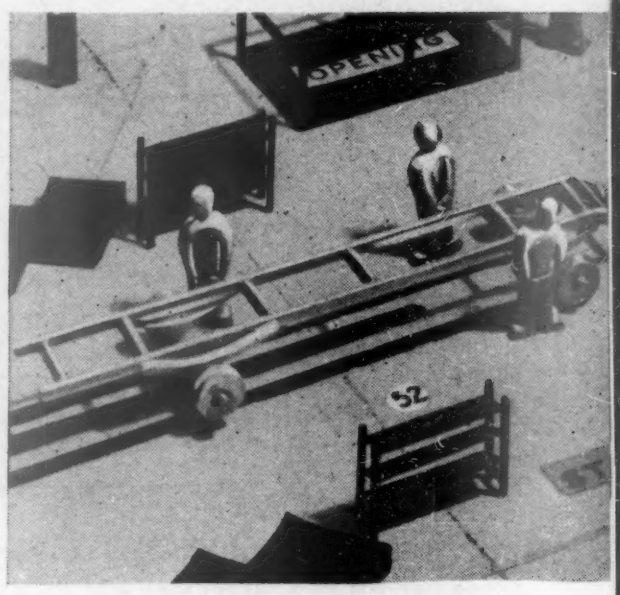


closures), and ends at upper left. Line at lower left is chassis assembly



TWO ENGINEERS discuss a minor adjustment in the cab line, squash a bug that might have crawled into the factory assembly line. Roof and walls are removable





MODELS look a lot like the real thing. No mistaking cab line with fork truck in foreground (left) or chassis (right) beginning its trip down the erection line

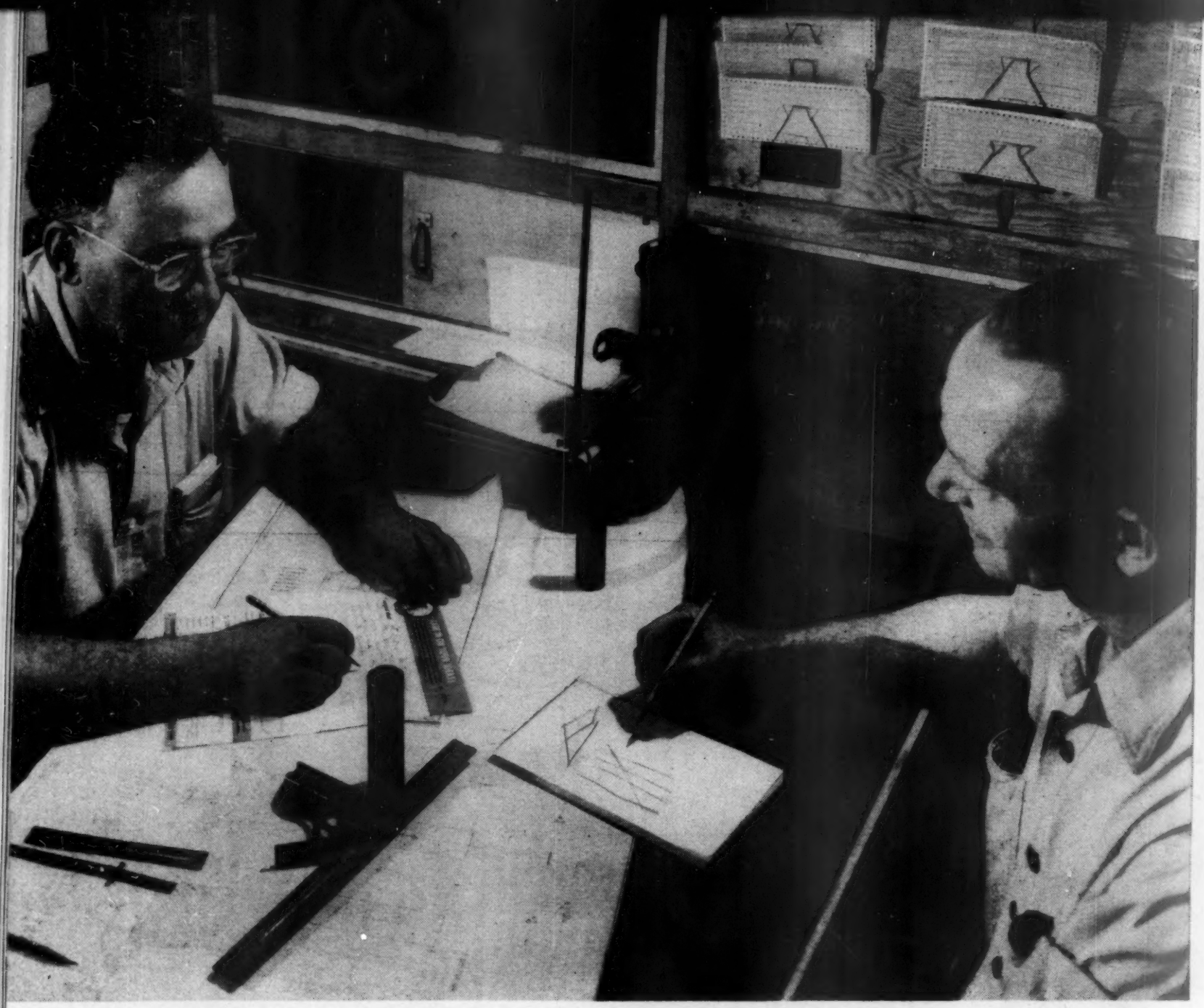
BUGS IN ASSEMBLY

study and investigation required several months. Actual operations were studied. For instance, the engineering department built a cab and assembled it with bolts and screws, instead of welding it. The cab was disassembled, and each panel or part given its correct part number. Estimates were then made showing the handling time, and the number of welds or screws, or both, required. Similar studies were made of subassemblies, chassis erection, bonderizing, and spraying, and the results were embodied in the construction of the model.

Using the model made it far easier also to determine the exact amount of space needed for each piece of equipment or function. Many hundreds of square feet of floor space that might have been allowed "to be on the safe side" could be saved by accurate planning.

Size of Building

The building that will house the truck assembly line is 130 feet wide, 400 feet long, with a total of 52,000 square feet of floor space. A full basement provides room for material storage as well as for such assemblies as tire mounting and installing engine accessories. The layout is predicated on a daily production of 50 cabs and 30 chassis, with a possible increase to 100 cabs and 50 chassis per day. This flexibility is provided by allowing for adjustment of line speeds, spacing of units, and addition of employees. Five power conveyor lines are contemplated—one for cab material, three for cab assembly, and one for chassis assembly. It is estimated that the complete assembly process from start to finish will take 8 hours and 32 minutes.



1. HEART OF PLAN is worker's assurance that foreman (left) will help him work out the details of the new method he wants to propose. Foreman is anxious to cooperate because he knows that he, too, will get a bonus if the suggestion is accepted

SUPERVISOR GETS BONUS WHEN

No danger of a foreman standing in the way of a worker with an idea. Not when it means money in his pants

CLARENCE E. ALBERT • PERSONNEL DIRECTOR, UNITED SPECIALTIES COMPANY, CHICAGO

SUPERVISORS get bonuses on their workers' accepted ideas at United. Thus the worker is not afraid to ask his foreman for help; the foreman is not afraid his department may be criticized; and company, foreman, and worker all benefit. Production is increased. Costs are lowered. Everyone makes more money.

Employees with ideas that will help improve operations seek the help of their supervisors in the development of their suggestions, before submitting them to the management committee. The supervisors often are able to be of considerable help by drawing diagrams or charts, and by writing a clearer cut and more concise explanation of the idea.

For his part, the supervisor receives an award. The rules for the suggestion system read:

"Foremen or department heads are excluded in direct rewards, but will be compensated for their cooperation with their employees to the extent of a flat 10 per cent of the award paid to the suggesters in their immediate departments."

How the Plan Works

W. Jessen, who ran a drill press, had been thinking for a long time about how to simplify the loading and unloading of his machine. The old screw vise tired him out. And, as he puts it, "consumed a lot of valuable production time."

2. **OLD METHOD** of de-burring involved hand tightening of screw vise and hand feeding of drill press

3. **PROPOSED METHOD** resulted in new machine. Parts are now clamped in the machine with foot-operated air vise

4. **PAYOFF** comes when suggester gets 25 per cent of estimated annual savings—and foreman (far right) gets his bonus

WORKER MAKES SUGGESTION

One day he got the idea that the part could be clamped in the machine with a foot-operated air vise. He felt sure this scheme would improve quality and quantity of the product, as well as lessen the fatigue of the operator.

Jessen decided to talk it over with his foreman. They sat down together in the supervisor's office and worked out the idea. The supervisor suggested a sketch to help explain the idea and assisted Jessen in writing a simple, easy-to-follow explanation on the suggestion blank. Thus the committee was able to take quicker action on the suggestion. (If the supervisor had believed the suggestion to be impractical, he would have tried to "un-sell" Jessen, but he would not have stopped him from submitting the idea.)

After a thorough survey, including time and methods study, the committee found that the idea would save United about $1600 a year in production costs and improved product quality. Jessen's share of the saving was $400—25 per cent of one year's savings—and the supervisor's reward was $40—10 per cent of the employee's award.

Jessen is now on a different job—one that regularly pays him more money. His suggestion enabled the company to turn his original job over to a girl. So from this one suggestion the company got increased production, better quality, lowered labor costs; Jessen got a better job, and $400 in cash; the supervisor got $40 for a few hours' work; and the girl got a job.

Added Advantages

Among the other benefits of this plan are the better acquaintanceships among workers and supervisors, suggestions of better quality and quantity—and elimination of dissatisfaction because supervisors are not eligible in the awards given for suggestions.

SECOND FLOOR. CONTINUOUS-ROW FIXTURES WITH DAYLIGHT LAMPS PROVIDE AVERAGE INTENSITY OF 85 FOOT-CANDLES

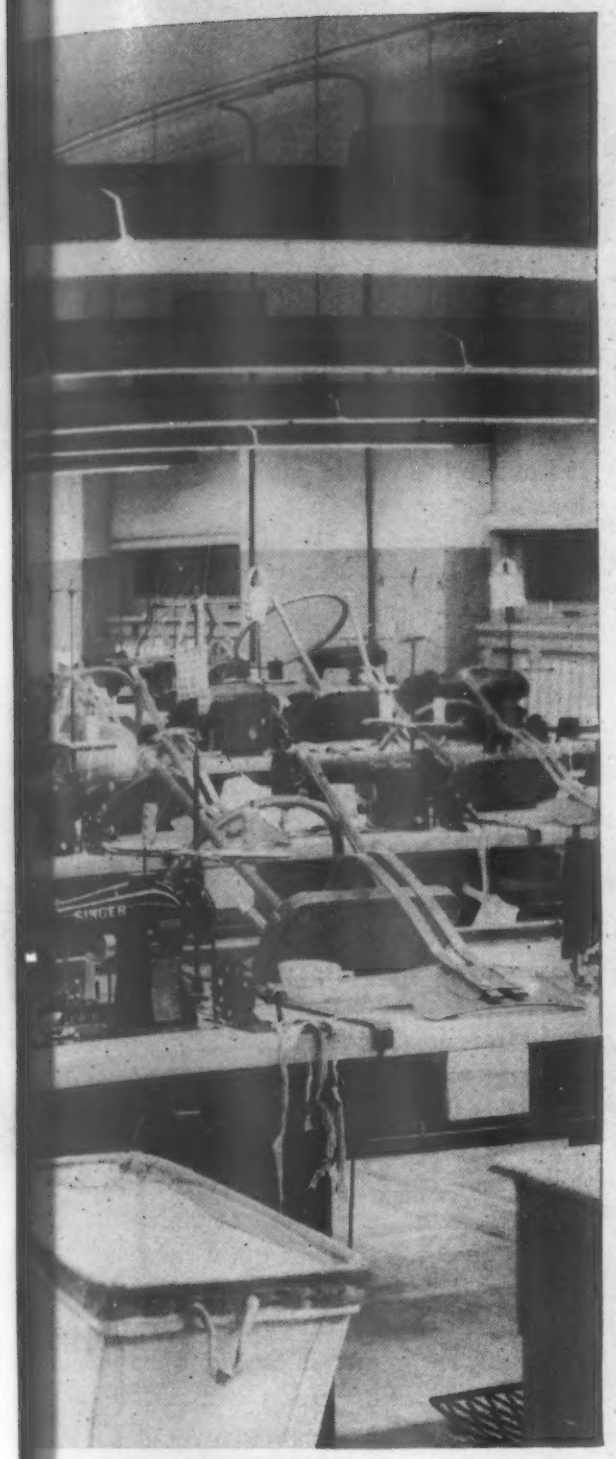
RELIGHTING FOR REAL SEEING

Gets 85 foot-candles at work level. First of two articles on lighting jobs that won prizes. Second in an early issue

Good lighting topped the "must" list when Divera Sportswear Company, Bayonne, N. J., remodeled its plant. This installation won a merit award in the competition sponsored by the Second International Lighting Exposition.

First floor—storage, packing, shipping, and offices. In the storage area, dresses are hung on racks built from floor to ceiling. Here light is provided by two 40-watt fluorescent lamps in fixtures on 6-ft. centers. In the main aisle and trucking areas the same type of fixture, mounted 10 feet high on 10x8½-ft. centers, is fitted with daylight lamps which produce 30 foot-candles.

Second floor—stitching operations. Sewing machines are mounted on tables 28 feet 6 inches long. Here 50-ft. two-light continuous equipment is used. Row spacing varies to conform with table spacing. The front edge of the reflector in each row is centered over the sewing machines, and the fixture is mounted 3 feet 9 inches above the table top. The average intensity is 85 foot-candles at the needle points, using 4500-deg. white lamps.



THIRD FLOOR. AVERAGE INTENSITY AT CUTTING TABLES IS 90 FOOT-CANDLES

FIRST FLOOR. APPROXIMATELY 30 FOOT-CANDLES IN AISLES AND STORAGE SECTION

Third floor—pattern and cutting areas. Three sizes of cutting tables are used—20 feet, 84 feet, and 104 feet. All tables are 36 inches high, 5 feet 2 inches wide. One row of continuous 50-ft., two-light, 40-watt equipment is mounted 4 feet above each table. As in the sewing room, 4500-deg. white lamps are used. The average maintained intensity at the center of the table is 90 foot-candles; at the edges, 60 foot-candles. Aisle lighting in this area is obtained with 200-watt RLM reflectors. This light is used as primary illumination when the cutting tables are not utilized.

Supplementing the lighting, to make this factory a good place to work, are inlaid wood floors, venetian blinds, and all new equipment.

EMPLOYEE RATINGS HELP GREATLY IN MANAGEMENT-WORKER DEALINGS

Every employee in this British plant has a heart-to-heart talk with the big boss every sixty days

FREDERICK W. REILLY • WORKS MANAGER, KRISSON PRINTING LTD. LONDON, ENGLAND

THE day we decided to give employees copies of their rating sheets, we moved the staff relations of Krisson Printing Ltd. a big step forward. Originally, rating sheets were used in connection with apprentices only and were mailed to parents. Later we began rating seniors at their request.

We did not find it an easy task to list the desirable—and less desirable—characteristics to be found in employees. The specimen sheet shown on the facing page does not represent finality, but of one thing we are certain: *Character is equal in importance to technical ability; the clever technician who curls his lip at friendly criticism, or who is undisciplined, may score less than the slow worker who is outstandingly cooperative.*

Preparing the Ratings

The foreman makes rating reports bimonthly. Since he may be obliged to explain any one of the ratings he will make, it follows that he becomes cautious and is forced to a high degree of accuracy. He finds it necessary to keep a diary to aid him. There can be no skimping. When an employee has been given a low rating, it is up to the foreman to watch for improvement. If he fails to report on such a tendency, the next report may well lead to a minor showdown for the foreman.

To offset the possibility of wide variation in the ratings of the staff, no foreman issues a report until it has been fully discussed with the works manager, who has an over-all picture of the staff and who is able to introduce a leveling factor. It is the works manager who sees *all* notebooks, whereas the foremen see only their own. He has access, also, to lists showing the use made of the library, the costs of individual spoilage, timekeeping, bonus pay, and class attendances. We try to make our ratings objective and there is little chance of an intolerant foreman rating punctuality as "needs reminding" when it is known that the employee has been late only twice in eight weeks.

The Personal Aspect

When reports have been issued, there follows a personal chat between the employee and the works manager. We consider this feature the most important aspect of our rating scheme. It will be readily appreciated how much scope there is for discussion when it is based on a progress report. Most managers are familiar with the hesitant feeling experienced prior to a showdown. These, and other things, come in a natural way under our rating scheme.

The personal interview is given in informal surroundings. We experimented with the idea of having an outside person chat with the worker but gave it up because we found that much of the discussion with the employee must be so technical that the works manager is best suited to the task.

Apart from going through the report with the employee item by item, there is always a list of stock questions if conversation lags. Thus:

"Are you completely satisfied with your bonus scheme?"

"Do you get on well with your foreman?"

"Are you satisfied with your future prospects?"

"Have you any worries at all—no matter how small?"

It is truly surprising how these and other questions lead to the solution of some hidden grievance—one which the employee may never have had the courage to bring forth were it not for the frank questions asked by management.

Where possible, immediate action is taken on the removal of minor grievances; the larger ones are looked into at an early date.

At one time, the lowest collective score for the staff was found to be on the art of criticism. So we launched a campaign. Posters were placed all around the shop. Full use was made of the notice board together with pay slips and a news sheet. The campaign culminated in a series of playlets depicting the frailties of human nature. When we came to record the next set of progress reports we were agreeably surprised at the marked improvement.

There are many aspects to the policy of issuing reports direct to the staff. Members of our organization have come to look upon themselves as counting for far more than a clock number; they know that their development is being aided and that no one person can make their jobs a misery—leastways, not without the opportunity for the employee to state his side and assert his own rights.

Having encouraged a standard of honesty between management and worker we have encouraged a further step forward between the workers themselves. Often, blank reports are issued and employees rate one another. In some ways they show a frankness which is best not dealt with here.

The scheme is not a difficult one to operate. All it demands is careful handling. The results can be as beneficial as management likes to make them.

REPORTS like this are made out also for each worker by his foreman, and reviewed with him by the works manager

Progress Report

ISSUED BIMONTHLY • DATE January '48 NAME Vernon Read

These reports are valuable, serving as a basis for promotion and discussion between parent, apprentice, and the firm. Each new report should be compared for progress with those previously issued. Parents are invited to discuss any points raised with the firm. Complete with parent's signature these rating charts MUST be placed in the operator's notebook.

TECHNICAL ABILITY — CHARACTER REPORT

ACCURACY AND CARE	Many errors and spoiled work 0	Careless 2	Average 4	Careful 6	Accurate 8 7	TOTAL 7
SPEED OF PRODUCTION	Very slow 0	Slow 2	Average 4	Fast 6 6	Very fast 8	6
CARE OF TOOLS AND WORKING SPACE	Untidy 0	Needs reminding 2	Average 4	Keeps space clean 6 6	Extremely clean 8	6
ACCEPTANCE OF RESPONSIBILITY	Refuses it 0	Evades it 2	Average 4 4	Accepts it quickly 5	Seeks it 7	4
ABILITY TO LEARN	Dull 0	Learns slowly 2	Average 3	Learns quickly 4 4	Brilliant 5	4
ABILITY TO DIRECT OTHERS	Antagonises 0	Lacks direction 2	Average 3	Helps 4 4	Organises 5	4
INITIATIVE	In a groove 0	Seldom offers suggestions 2	Average 3	Sensible suggestions 4 4	Very original 5	4
NOTEBOOK AND LIBRARY	Opposes 0	Minimum effort 2 2	Average 4	Trying hard 5	Brilliant 6	2
CLASS ATTENDANCES	Disinterested 0	Occasionally attends 2 2	Average 3	Very good 4	Super attendance 6	2
ATTITUDE TOWARDS FELLOW WORKERS	Puts blame for errors on them 0	Does not cooperate 2	Neutral 3	Helpful 4 4	Extremely considerate 5	4
ATTITUDE TOWARDS THE MANAGEMENT	Noticeably antagonistic 0	Does not respond 2	Cooperates quietly 4	Cooperates actively 6 6	Outstandingly cooperative 8	6
ATTITUDE TOWARDS CRITICISM	Resents criticism 0	Disregards criticism 2	Average 4 4	Heeds criticism 5	Seeks criticism 6	4
DISCIPLINE	Needs watching 0	Needs reminding 2	Seldom fails 4 4	Extremely good 6	Influences others 8	4
OBSERVANCE OF SAFETY RULES	Disregards 0	Forgets 2	Average 3	Observes most rules 4	Observes all rules 5 5	5
PHYSICAL CONDITION	Very poor 0	Many minor ailments 2	Average 3 3	Good 4	Very good 5	3
PUNCTUALITY AND TIME CLOCK	Consistently late 0 1	Needs reminding 2	Occasionally fails 3	Very good 4	Outstanding 5	1
For outstanding achievement(s) the employee may be awarded an extra 1—8 points.				HIGHEST POSSIBLE POINTS 100		66 BONUS AWARD

The question of whether an apprentice remains with the firm on completion of his apprenticeship partly depends on these reports

A bonus of 5/- is awarded an apprentice each time he scores 80 points or more

During the period of apprenticeship the operator earning no bonuses may not be given the option of continued employment

F. Browne
Rated by Works Manager

R. Tovere
Assisted by Foreman

Sinn
Approved by Director

Examined Parent

GENERAL COMMENTS

Both Fred and Rog agree that the last two months represent Vernon's best effort at K.P.L. He appears to have conquered most of his moody spells, works well, and is in every way an asset to his department.

Suggestions -- cure tendency towards absent-mindedness. Improve time-keeping and get started immediately after clocking.

KRISSON PRINTING LTD • CRAVEN HOUSE • FOUBERTS PLACE • LONDON • WI

RUSSIANS went on a buying spree in December when the ruble was devaluated and rationing was abandoned. Farmers, black market operators, speculators, and cooperatives took a terrific beating. But workers got an increase in living standards

THE TRUTH ABOUT THE

L. C. MORROW • EDITOR, *FACTORY*

In July, 1947, FACTORY presented a report on "How Factory Workers Live Around the World." The lot of the American working man was compared with the lot of comparable workers in 13 other countries. Conspicuous by its absence from that article was a report on the condition of the Russian worker. The reason for this was simple: *Censorship.*

The only information available to FACTORY at that time was what the Russian government-controlled information bureau chose to provide. Well-informed observers told the editors it was colored, unreliable.

Since last summer McGraw-Hill's Washington Bureau and World News staff in New York have been assembling data from competent reporters, business men, and travelers returning from Russia. Unhampered by censorship, here is my first-hand report of their findings on the current economic position and outlook of the Russian worker.

THE most important happening in the life of the Russian worker since the outbreak of the war—perhaps on a par with the advent of the first Five-Year Plan—was the devaluation of currency which took place in December.

First effect of the devaluation was virtually to wipe out the savings of the worker who had been frugal enough to put anything aside. The second effect was to *raise* the standard at which the worker can live on his current income. This was true because, simultaneously with the devaluation, wages were frozen and rationing was abandoned. Officially, the somewhat peculiar Russian system of price control was abandoned, too. Result: *Cost of living dropped sharply.*

Here is how it worked. Formerly, a three-price system prevailed in the Soviet. At government-owned shops it was possible to buy, *with* ration coupons, just about enough to provide minimum subsistence. The "legal" black market (government-operated) sold *without* coupons at much higher prices. Cooperative stores and other operators in the "open market" were independent of government regulation, but in general sold at or near the black market level.

With the end of rationing, all government stores began selling at the previous "ration prices," and in some cases less. With the 10 to 1 devaluation, that meant prices reduced to one-tenth of their former level (in relation to wages). The only question was: *Would the supplies the government had hoarded in the past two years hold out until open market prices had been driven down to competitive levels?* At

NEW HOUSING UNITS are getting high priority, will match U. S. "low-cost" projects. And Russian workers pay out only 8 to 10 per cent of their incomes in rent. But most housing is far below American standards, and shortage is much greater than ours

RUSSIAN WORKER

last report, the answer appeared to be an almost unqualified *yes*.

In the first days after the December decree, there was a tremendous buying rush. People refused to believe that supplies could last, ran to stock up. But as stocks held, confidence grew. And while Russians are still on an eating binge after six years of substandard diet, panic buying has ceased.

Consensus: Farmers, open-market operators, speculators (there were plenty in "non-capitalist" Russia), and cooperatives have taken a terrific beating; but workers have received an important and probably permanent increase in their standard of living.

Just where does this leave the Russian worker? With all his new advantages, with prices at one-tenth the previous level, how does the Russian worker fare, compared with a worker in the United States?

Well, it still takes him roughly ten times as many minutes of work to earn the price of a loaf of bread or a dozen eggs, or other consumer goods.

On the other hand, the typical Russian worker spends only 8 to 10 per cent of his income for housing. Accommodations, by and large, are considerably below American standards, but are generally described as adequate. In war-devastated western Russia, there is still a tremendous housing shortage; but new units are getting high priority and will provide accommodations comparable with those in many of the "low-cost" multiple dwelling units now being built under subsidy in the United States.

Utilities Are Low-Priced

Utilities are not as generally available as in the United States, but prices are almost ridiculously low. Telephone service in Moscow costs 5 rubles a month (about 40 cents), for which the subscriber gets an unlimited number of calls. Gas, heat, and electricity are equally cheap.

This is what one Moscow veteran observer told FACTORY'S representatives:

"Every utility service is within easy financial reach of virtually every Russian city dweller—and within the reach of a surprising number of rural residents. The only problem now is installation of additional facilities to meet the demand. While this process will require many years yet, it is proceeding rapidly."

Taken on the whole, the present diet of the Russian worker is pretty fair. For the first time since 1940, he enjoys meat and butter on his menu about twice a week. He can get all the bread he wants, although he can buy only 2 kilograms at a time. (But he can return as many times as he wants to repeat the purchase; this restriction was to prevent farmers from buying unlimited quantities of bread for livestock feed—a very profitable practice.)

An "average" worker and an "average" wage are hard to define even in the United States, where extensive statistics are accumulated by government agencies and made public. It is next to impossible to define them in the Soviet Union, where whatever statistics may exist are kept under lock and key by the Politburo.

Consequently, FACTORY wanted to know how the usually cited

WHAT HAPPENED TO THE RUBLE

(Currency Reform of December, 1947)

	NEW CURRENCY
CASH	
Each 100 rubles now worth	100 rubles
BANK DEPOSITS	
First 3000 — each 100 rubles now worth	100 rubles
Next 7000 — " " " " "	67 "
Over 10,000 — " " " " "	50 "
GOVERNMENT BONDS	
Type A (similar to U. S. "E" bonds) — each 100 rubles now worth 100 rubles. Others — each 100 rubles now worth 20 to 33 rubles	

figure of 500 rubles per month was arrived at—other than that it was a nice round number. Observers returning from Russia vary slightly in their opinion of what the average wage actually is. Some say it *may* be as high as 600 rubles; others say it *may* be as low as 425 or 450. Most are willing to agree that 500 is a satisfactory basis for comparison.

Piecework Widely Used

The spread in worker earnings is far more pronounced than in the United States. Virtually all production is on a piecework basis, and, to provide incentive for the development of better methods, the Russians permit a man to "run away" with his job if he can "improve" it by his own effort or ingenuity. Consequently, some production workers can be found who are earning as high as 2500 to 5000 rubles a month.

At the other end of the scale are the watchmen, sweepers, and the like. Their earnings may be as low as 100 to 150 rubles per month.

In general, the piece rates are set to reflect the amount of manual labor required for a job. However, the wartime demand for skilled work brought into the picture a recognition of this element in determining pay.

One thing is stressed in reports about the working of the piecerate system. Russian workers like it. And they know it was imported from America. This continues to sustain in the mind of the Russian worker a great admiration for American industry, and so for America in general. For years, official Soviet propaganda praised American industry and its technology. The "line" has now changed —but Pravda had done its work well, and much of the recognition of America's productive genius remains with the Russian worker.

One other factor is important in connection with Russia's "average" wage. Practically everybody in Russia works. The housewife with small children leaves them at a state-operated kindergarten while she is in the factory. The result is that the average *family* income in Russia is far higher (compared with individual income) than it is in the United States.

Additionally, many Russians hold two jobs. Although the basic work week is 48 hours, many a worker in the Soviet takes on another part-time job. In Western Russia, particularly, there is much to be done to clear away the wreckage of war, and it is a simple matter to get work in the "reconstruction." The shortage of labor compared to the job to be done can only be described as "magnificent." But just how much such work adds to the "average" income is an imponderable.

In somewhat striking comparison to the wildly fluctuating wages of the production workers are the fixed salaries of the managers. These range from a minimum of 400 to a maximum of 3000 rubles per month. Thus it is by no means unheard of for production workers to earn more than the factory manager.

However, under the rationing system the managers were more privileged than the rest of the people. This was partly because of the position they occupied, and partly because many of them took unfair advantage of that position. The new decree will have the effect of worsening the economic lot of the managerial class in the "classless" Russian society.

This, then, seems certain: *Russian workers are better off today than at any time since 1940; perhaps better than ever before. But in terms of American standards, they are little, if any, better off than what in the U. S. is considered a "decent minimum" standard of living.*

What's Ahead?

What of the Russian worker's future? Will his lot continue to improve? Or can he look forward only to war?

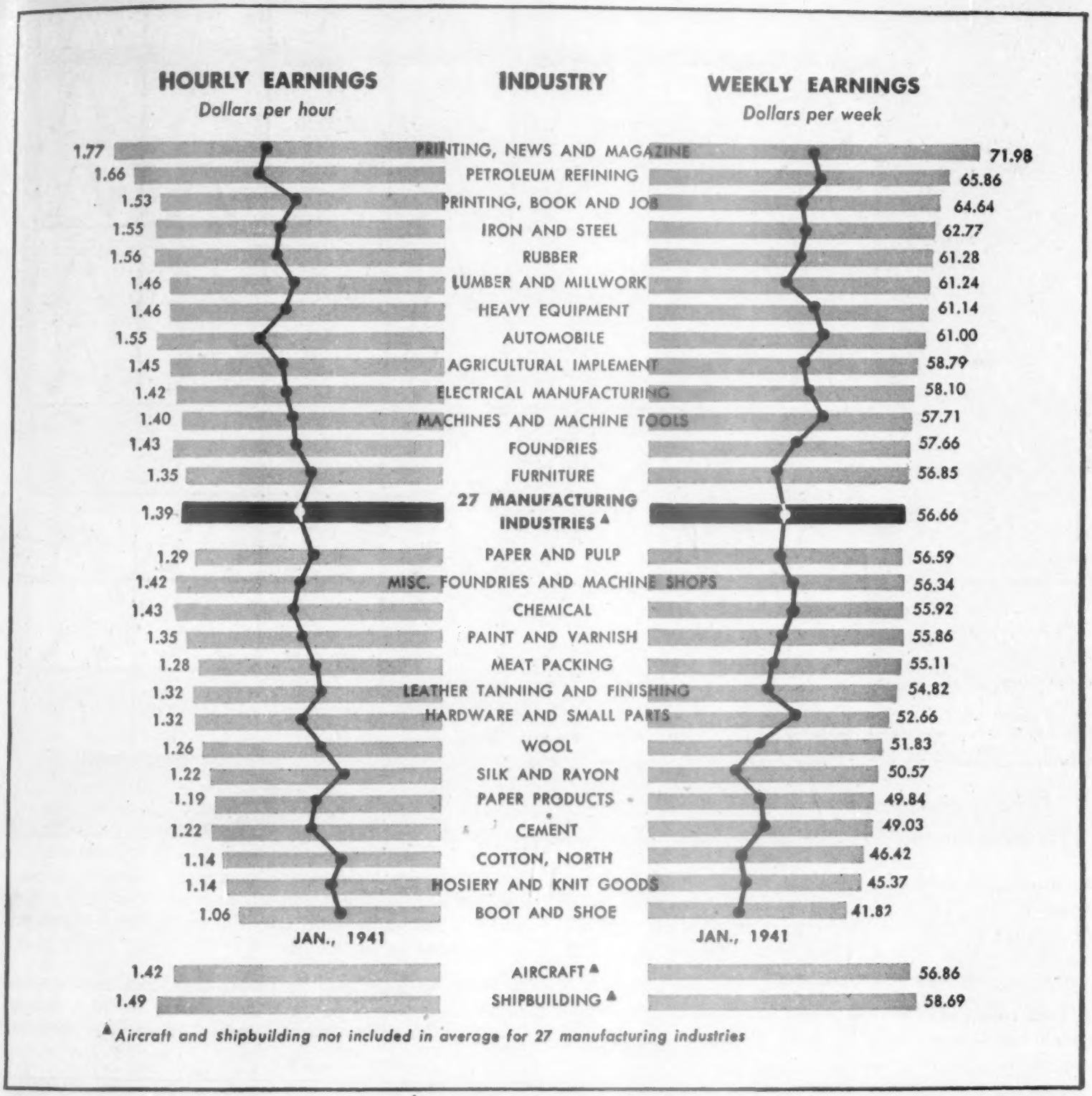
Russia's biggest job at the moment is reconstruction. She is busy rebuilding war-torn cities and rebuilding war-torn industries. Every step taken is automatically a step in the direction of a higher standard of living. But every step is also a step toward a *possible* war. Most, though not all, observers emphasize the word *possible.*

The important point is this: Highest priority is being given to the rebuilding and expansion of heavy industry and transport facilities. Consumer goods, for which there is a crying need, are being left by the wayside.

Stalin is being cagy. He is not building a war *plant.* He is building a war *potential*—i.e., facilities capable of rapid conversion to production of war matériel and to production of a war plant. When this program of construction is completed, Russian workers will stand at a crossroads. And their masters in the Politburo will decide which way they go.

At that point it will be possible to turn Russia's heavy industry to the task of making Russia a military giant. Or it can be turned to the production of a consumer-goods industry that might concivably make the Russian people among the richest on earth.

As of 1948, it seems highly improbable that the Russian people will have any voice in that decision.


HOURLY EARNINGS
Dollars per hour
INDUSTRY
WEEKLY EARNINGS
Dollars per week
1.77 PRINTING, NEWS AND MAGAZINE 71.98
1.66 PETROLEUM REFINING 65.86
1.53 PRINTING, BOOK AND JOB 64.64
1.55 IRON AND STEEL 62.77
1.56 RUBBER 61.28
1.46 LUMBER AND MILLWORK 61.24
1.46 HEAVY EQUIPMENT 61.14
1.55 AUTOMOBILE 61.00
1.45 AGRICULTURAL IMPLEMENT 58.79
1.42 ELECTRICAL MANUFACTURING 58.10
1.40 MACHINES AND MACHINE TOOLS 57.71
1.43 FOUNDRIES 57.66
1.35 FURNITURE 56.85
1.39 27 MANUFACTURING INDUSTRIES ▲ 56.66
1.29 PAPER AND PULP 56.59
1.42 MISC. FOUNDRIES AND MACHINE SHOPS 56.34
1.43 CHEMICAL 55.92
1.35 PAINT AND VARNISH 55.86
1.28 MEAT PACKING 55.11
1.32 LEATHER TANNING AND FINISHING 54.82
1.32 HARDWARE AND SMALL PARTS 52.66
1.26 WOOL 51.83
1.22 SILK AND RAYON 50.57
1.19 PAPER PRODUCTS 49.84
1.22 CEMENT 49.03
1.14 COTTON, NORTH 46.42
1.14 HOSIERY AND KNIT GOODS 45.37
1.06 BOOT AND SHOE 41.82
JAN., 1941
JAN., 1941
1.42 AIRCRAFT ▲ 56.86
1.49 SHIPBUILDING ▲ 58.69
▲ Aircraft and shipbuilding not included in average for 27 manufacturing industries

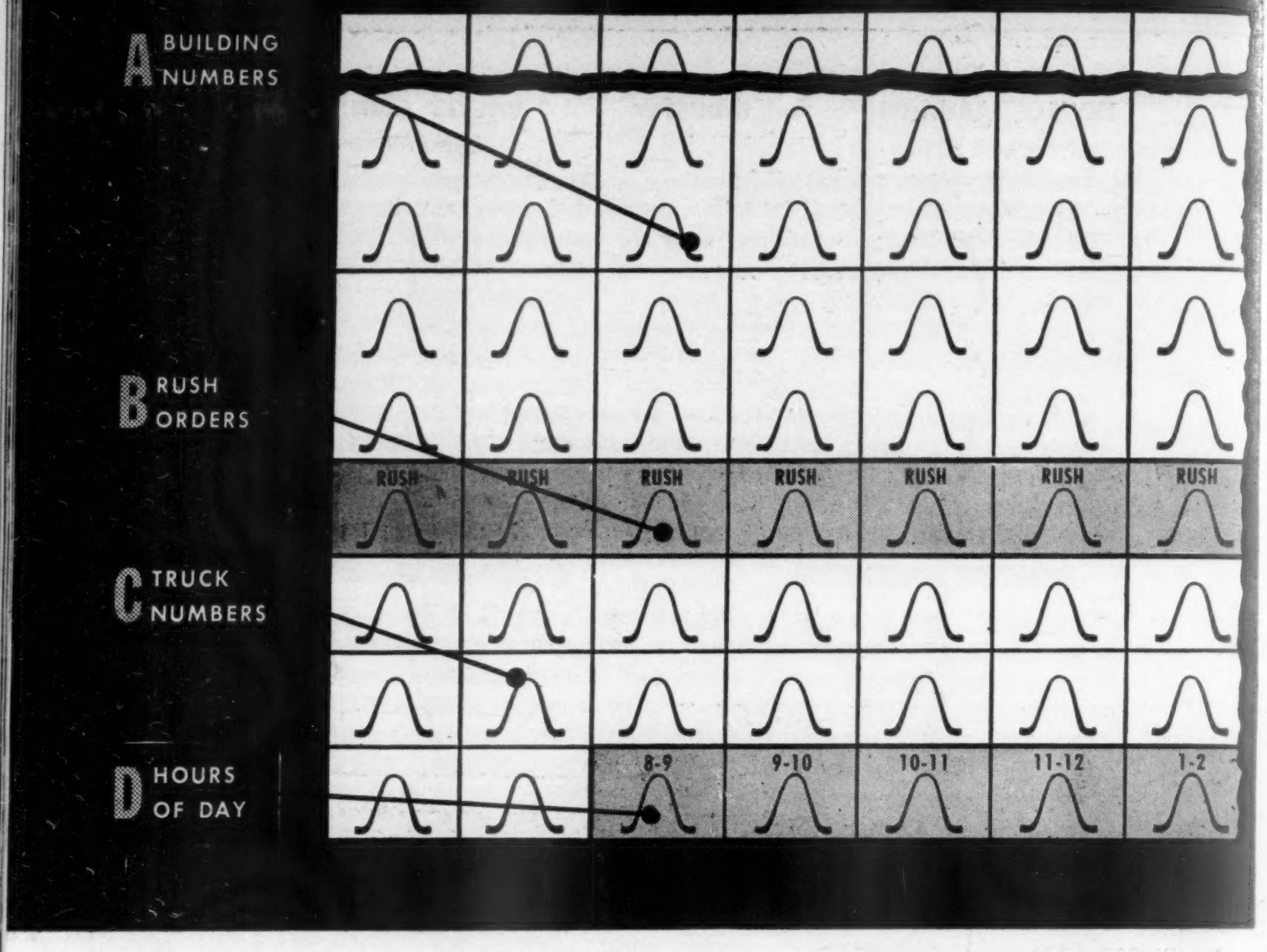
BASED ON NATIONAL INDUSTRIAL CONFERENCE BOARD FIGURES. PUBLISHED IN NICB'S SERIES, "ROAD MAPS OF INDUSTRY"

HOURLY AND WEEKLY EARNINGS

29 Manufacturing Industries, Average October, 1947

WEEKLY earnings of production workers in 27 manufacturing industries (aircraft and shipbuilding, shown on above chart, are not included in the average) surveyed by The National Industrial Conference Board averaged $56.66 in October, 1947. They have risen 84.9 per cent since January, 1941, base date of the Little Steel formula. This change results from an 82.4 per cent increase in hourly earnings and a lengthening of the work week from 40.2 to 40.8 hours.

Increases in the weekly earnings of individual industries ranged downward from 168.7 per cent in the silk and rayon industry. Other large increases were 133.6 per cent in the northern cotton industry, 119.3 per cent in the hosiery and knit goods industry, and 111.3 per cent in the wool industry. *Source:* National Industrial Conference Board.



1. Orders for trucks are telephoned in by production supervisors to central dispatcher. He writes each trucking order on duplicate white and yellow form showing all requirements as to type of load, where it is to be picked up and delivered, and time service is needed

2. Both copies of order are placed in section A of the dispatch board, specifically in upper of two spring clips of whatever space designates pick-up point. If order is urgent, it is placed in spring clip in any open space in section B. If order is for other than the day on which it is issued it is placed in section E

3. When an assignment is made, dispatcher removes the order from section A, gives yellow copy to truck driver, and transfers white copy to section C in the space denoted

DISPATCH BOARD CONTROLS

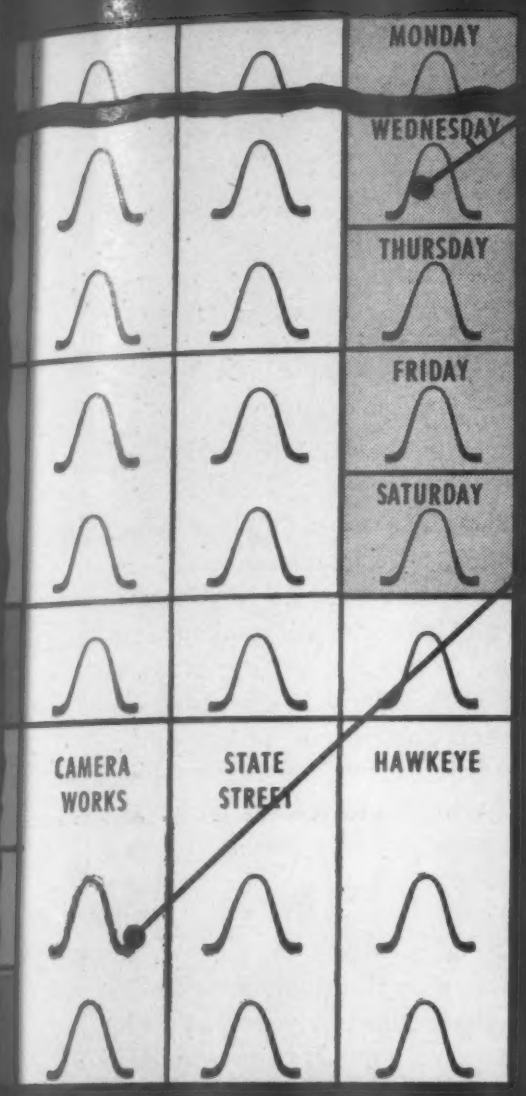
Here, interbuilding moves by motor truck. Could be used just as well for intrabuilding moves by power truck

E. L. COOK • SUPERINTENDENT OF YARD DEPARTMENT, KODAK PARK EASTMAN KODAK COMPANY, ROCHESTER, N. Y.

A MOTOR truck dispatching board efficiently controls the daily truck movement of many tons of materials among 100-odd manufacturing and service buildings at Kodak Park. These buildings are scattered over 400 acres of ground interconnected by 10 miles of roadways.

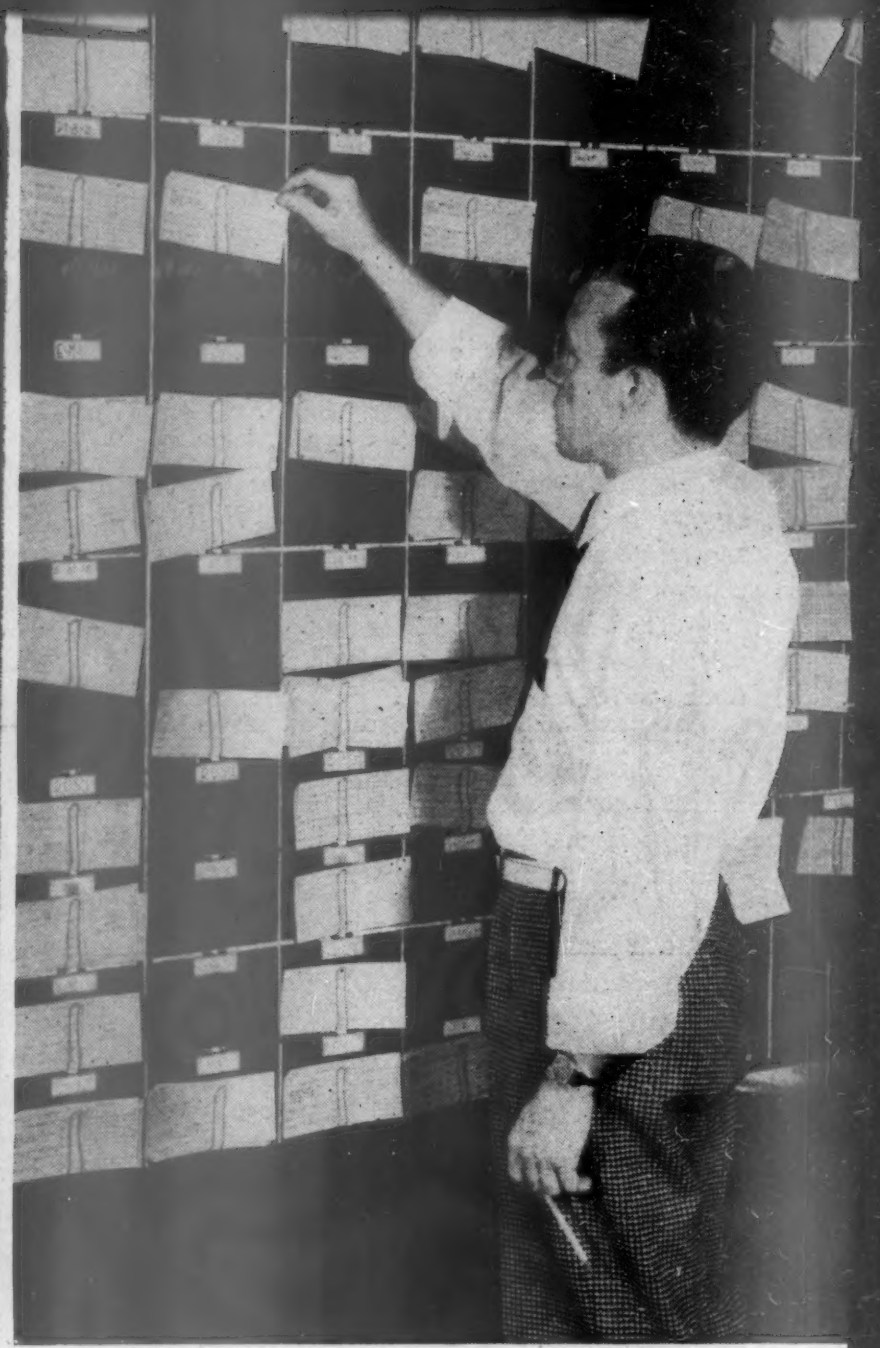
The system governs the operation of a fleet of 28 trucks, 2 tractors, and 9 trailers used for intraplant haulage of work-in-process, maintenance materials, and general supplies. Also included are pick-up and delivery services to other company plants in Rochester, messenger delivery service of any special nature, as well as the pick-up of mail several times daily at the main city post office.

In all instances the services of



E DAYS OF WEEK

F OTHER PLANTS



by truck number receiving assignment. Notations of time and truck are made accordingly on both copies. Driver makes all entries in "start" and "finish" column

4. On completion of truck delivery, driver reports back to dispatcher for further instructions, and surrenders his completed yellow copy. This copy is marked with "finish" time, and is sent at close of day to accounting department for allocation of cost of trucking service. White copy is transferred back to lower clip of originating department in section A, and is filed departmentally at close of day

5. Daily standing orders for services at specific hours, such as mail pick-up, are held for assignment in section D. Services to other plants of company in the city are controlled by segregating such orders in section F

MOVES BY TRUCK

this system are limited to use of a truck with a driver. Where extra yard labor is needed for movement of heavy materials, a separate dispatch board is used (see "Lower Yard-Labor Costs By Planning Every Move," FACTORY, February, 1945).

In actual operation, a single large 5x10-ft. board stretched diagonally across one of the rooms in the service department headquarters is used for both systems. Each system operates independently of the other on opposite sides of the board.

How System Works

Diagrammatic layout and a partial view of the truck dispatch board are shown above on this and the facing page. Details of the system's operation are given under the schematic diagram above.

Orders are telephoned in to the central dispatcher by an authorized supervisor from any building whenever he needs truck service. The dispatcher writes out the order on a special paper form, 3¼x7¼ inches in size, which has a carbon-backed white original and a yellow index-quality duplicate (illustrated on the following page). This set is then placed under a spring clip in one of the spaces on the dispatch board. It goes into sections A, B, C, D, or F,

depending on the nature of the call, and is held there for dispatching.

Usually the order is put in section A. Spaces in section A are arranged to show building numbers to conform as nearly as possible to the actual geographical layout of the plant. Each space represents one building or group of buildings. This layout helps to plan moves for shortest travel as well as to obtain prompt service.

Orders that are to be executed on subsequent days are accumulated under one of the six weekday spaces in section E. When the due date arrives these orders are distributed to the other sections as if they had been received.

Requests from the other two plants and the city office of the company are placed in section F according to their origin.

Daily Orders

In section D, containing nine hourly spaces for the 8 a. m. to 6 p. m. period of the day, are placed all orders requiring service at an exact time of the day. This section usually contains about 75 standing orders that require some kind of attention daily.

All "rush" orders are placed in spaces in section B in combinations as nearly geographical as possible. There are 13 individual "rush" spaces, which are usually enough to take care of whatever efficient combinations can be made.

The stage is now all set for the dispatcher. As trucks complete their assignments and become available for a new job, he decides from a quick review of the board what next to give them.

Then as orders are assigned they are transferred from any one of the aforementioned sections to section C. This section has a separate space for each motor vehicle controlled by the board. Work load of each truck is therefore apparent at any time of the day.

When making the assignments the dispatcher tries to combine as many orders as feasible to get the least lost motion and backtracking of truck equipment. The localization of orders in section A of the board helps considerably in this effort.

Handling Special Orders

Because he knows where his trucks are going, the dispatcher can get in touch with drivers to insert special orders if necessary. Drivers also customarily telephone the dispatcher at the end of a run for possible special instructions before returning to the dispatching office.

This system, now in effect for over 10 years, has proved indispensable in the efficient and economical handling of intraplant shipments. The truck fleet and dispatcher, as a part of the plant service organization, are giving manufacturing departments first-class service which could not be duplicated by having each department or group of buildings operate a truck of its own. Also, because of the flexibility in making assignments, trucks can be withdrawn individually for overhauling or maintenance whenever necessary without inconvenience to any one area.

Every Month . . .

AMONG THE ADVERTISING PAGES, these valuable aids to low-cost production: the plant operation man's guide to **WHAT'S NEW IN EQUIPMENT** (page 140) . . . a summary of **LABOR DEVELOPMENTS** (page 222) . . . things **YOU WANT TO KNOW** more about (page 212)

TRUCK NO. 189G DATE: 1/16/48

CHARGE TO: 465

MATERIAL TO BE HAULED: 8 skids of paper

BUILDING	DOOR		BUILDING	DOOR
204	10	FROM / TO	48	G

ORDERED BY: Ray

REPORT TO: Print Dept.

TIME WANTED: Today

DRIVER: Shaw

START	
FINISH	
START	
FINISH	
TOTAL	
NO. OF ¼ LOADS	
TRIPS	

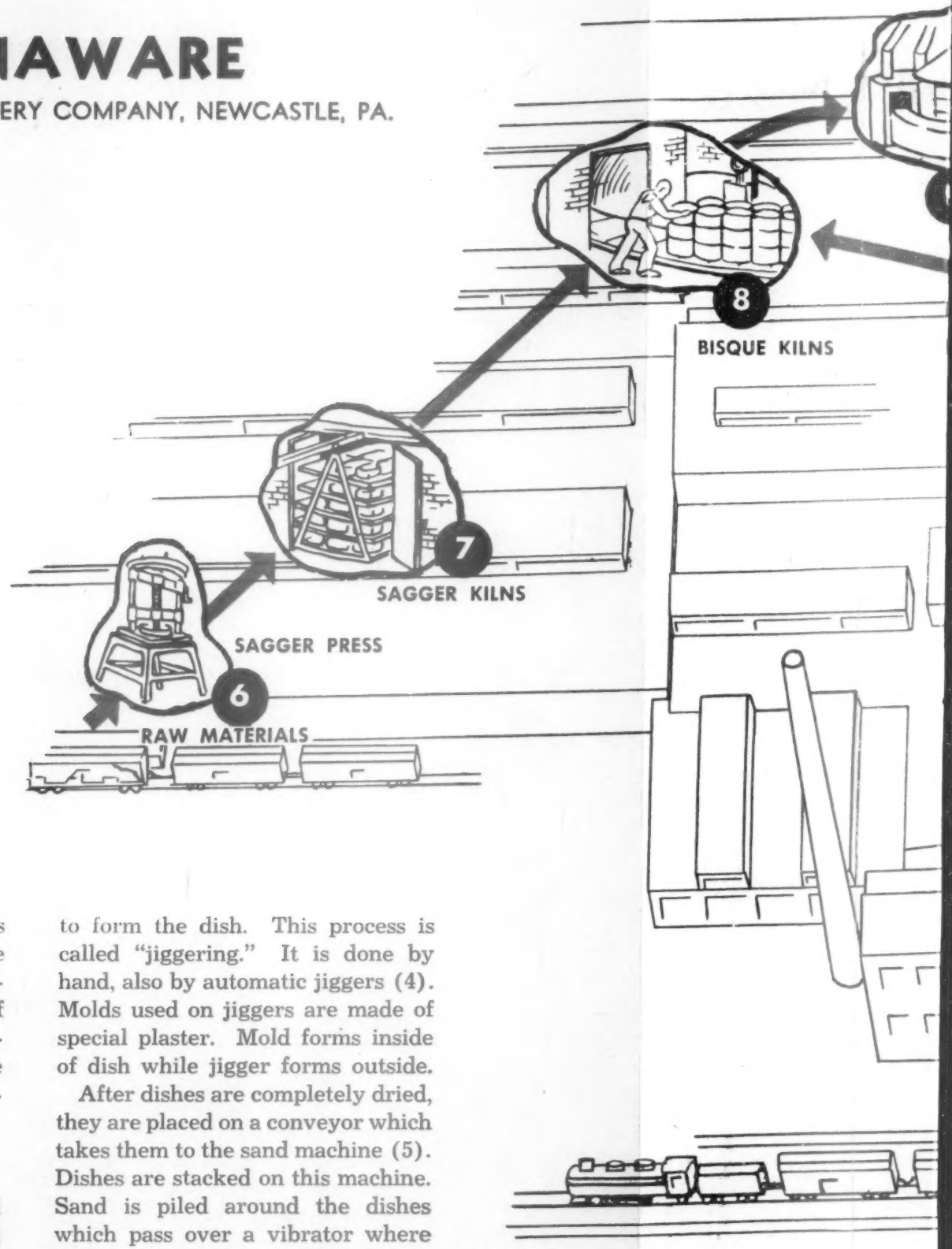
DO NOT WRITE IN THIS SPACE

EASTMAN KODAK COMPANY, KODAK PARK, ROCHESTER, N. Y.

ORDER FORM is filled out in duplicate every time dispatcher receives a telephone request from plant. He enters all items except "start" and "finish" column, which is done by truck driver. Space at right is reserved for key punching

3. CHINAWARE

SHENANGO POTTERY COMPANY, NEWCASTLE, PA.



STRAIGHT-LINE FLOW characterizes the manufacture of dinnerware and hotelware at Shenango. Production begins with the receipt of raw materials at lower left. Numerals in text are related to the numbered sketches in the production flow chart.

Raw Materials

Raw materials are received and stored in bins, then taken as needed to the slip department. Ball mill (1) is used to grind sand, marble, and feldspar, which are mixed and blended with the clay to form the "body" used to make ware of all shapes and sizes. Water is filtered out. Clay is put into a pug mill (2) where it is thoroughly mixed and all air removed.

Jiggering

Clay is then sent to department where dishes are made. Body is pressed onto molds (3) and turned to form the dish. This process is called "jiggering." It is done by hand, also by automatic jiggers (4). Molds used on jiggers are made of special plaster. Mold forms inside of dish while jigger forms outside.

After dishes are completely dried, they are placed on a conveyor which takes them to the sand machine (5). Dishes are stacked on this machine. Sand is piled around the dishes which pass over a vibrator where sand is vibrated between the dishes. Dishes are then placed in saggers and moved via conveyor to the bisque kilns.

Sagger Manufacture

Saggers are manufactured in the refractories division. Here the material is mixed and pressed into shape by means of a sagger press (6). Saggers are then placed on conveyor racks which pass through a drier. After drying, saggers are finished smooth and fired in a kiln (7). This firing hardens the saggers so they will not break easily.

Bisque Kilns

Dishes are placed in saggers, as previously stated, and conveyed through a circular bisque kiln (8) where the temperature reaches a maximum of 2220 deg. F. There are four bisque kilns in production 24 hours a day.

As ware emerges from the kiln, it

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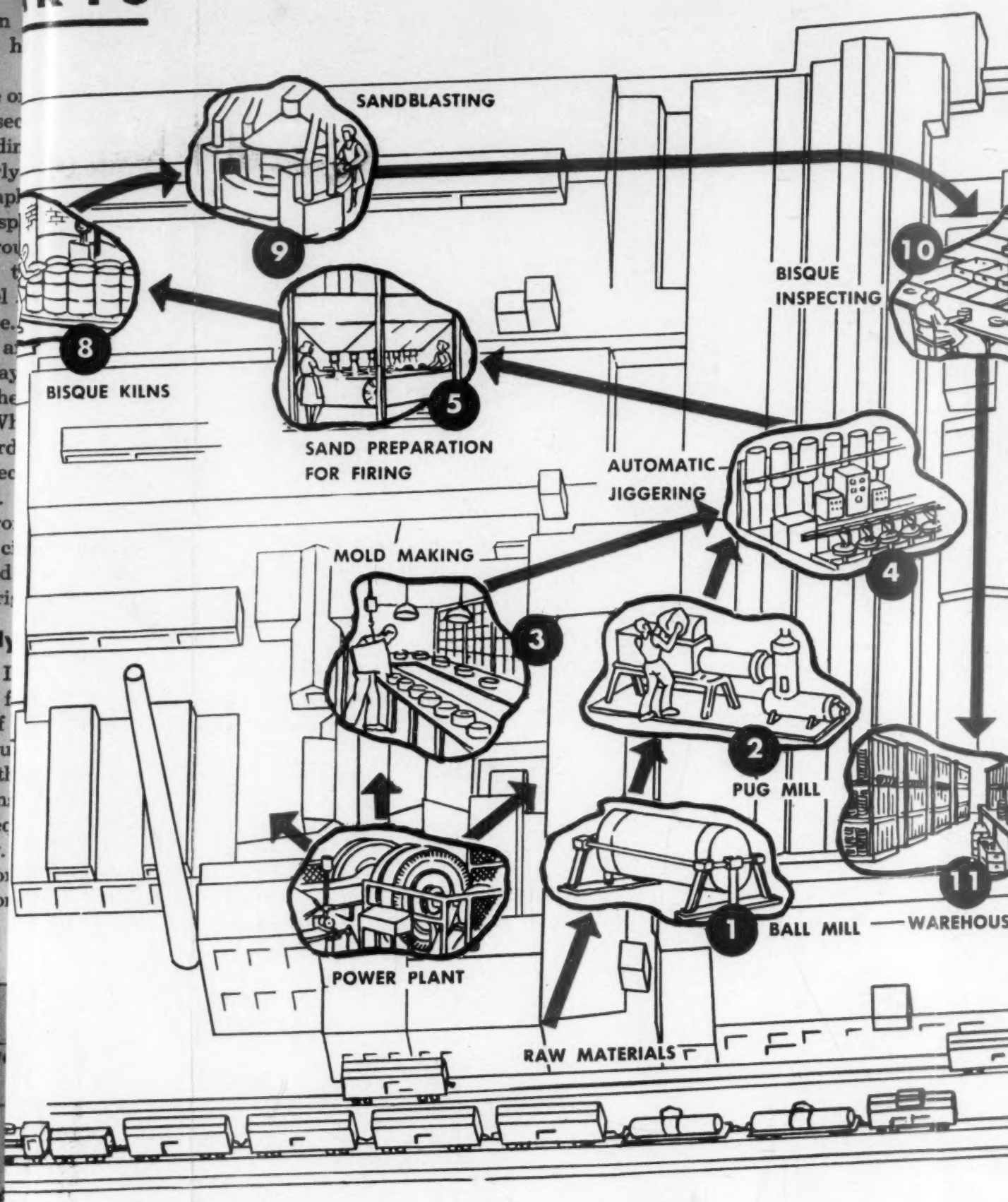

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rges from the kiln, it is removed from the saggers, taken to a sandblasting machine (9), and cleaned.

Dishes are next conveyed to the bisque inspection department (10), then taken to the warehouse (11).

Decorating

From the warehouse some of the dishes go to the lining department (12) where line decorations are put on. Others go to the print decorating department (13) where flowers and designs are transferred to them.

Glazing

Ware then travels to the glazing department (14). Here the glaze that has been prepared in the frit manufacturing (15) and glaze manufacturing (16) departments is applied. The ware also receives some color which is made in the color mixing department (17). There are

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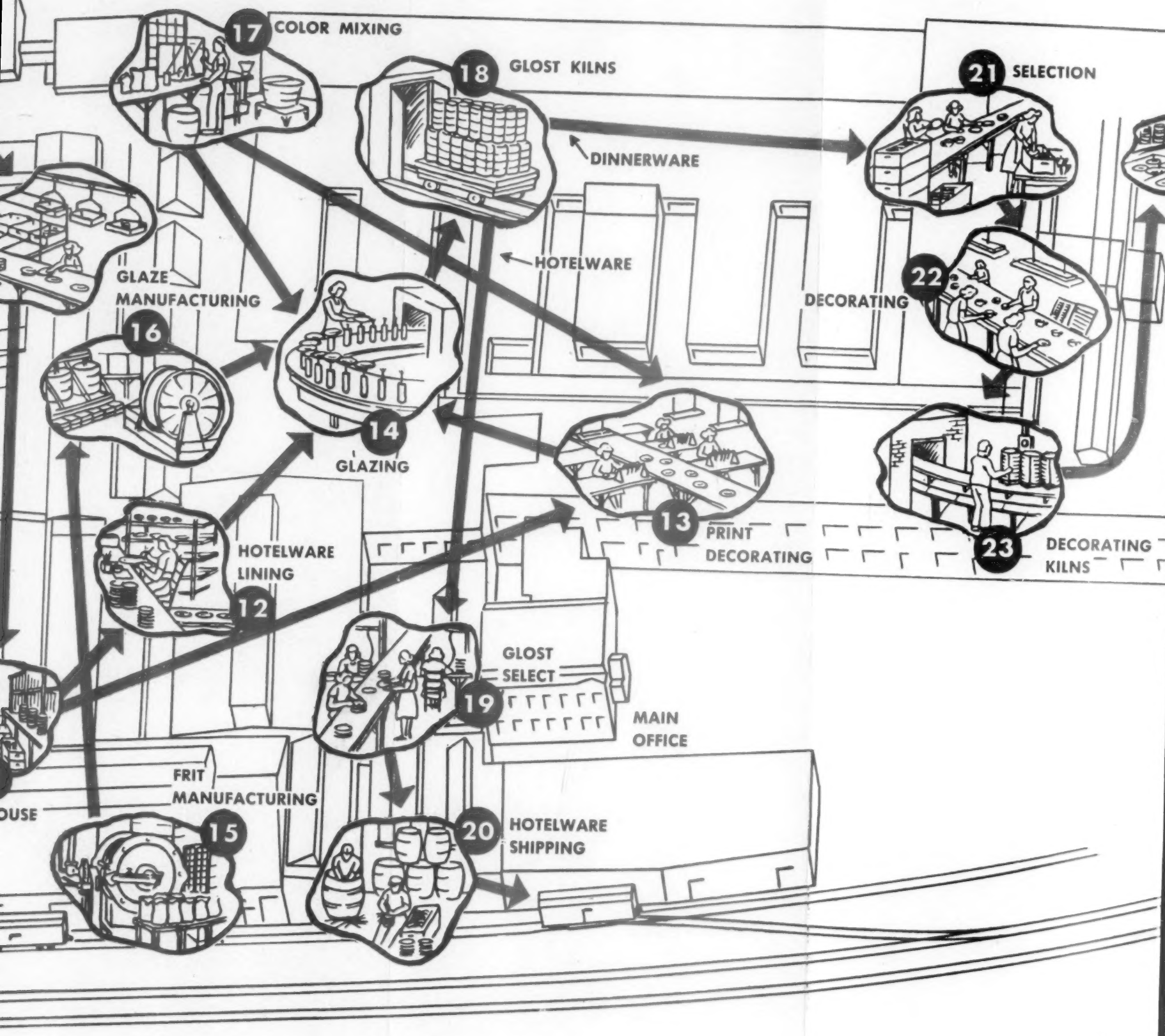

two methods of applying glaze. One is to dip the ware into the glaze. The other is to spray the glaze onto the dish. In this latter operation the ware moves by conveyor through a series of spray guns, then through a gas flame to dry the glaze.

Glost Kilns

Next step is to place the ware on triangular separation pins in saggers and take it to the glost kiln (18). In these kilns extreme temperatures, rigidly controlled, develop the hard, bright glaze. Two types of dishes are fired in the glost kilns—underglaze decorated ware and overglaze ware. The former has been decorated before glazing; the latter is decorated after glazing.

Hotelware

At this point, hotelware and dinnerware travel different paths.

Hotelware is taken to the glost selection department (19) where it is inspected and classified as to size and decoration. Selectors are responsible for matching sets. Ware is then sent to the hotelware shipping department (20) where it is packed with straw and placed in barrels for shipment.

Dinnerware

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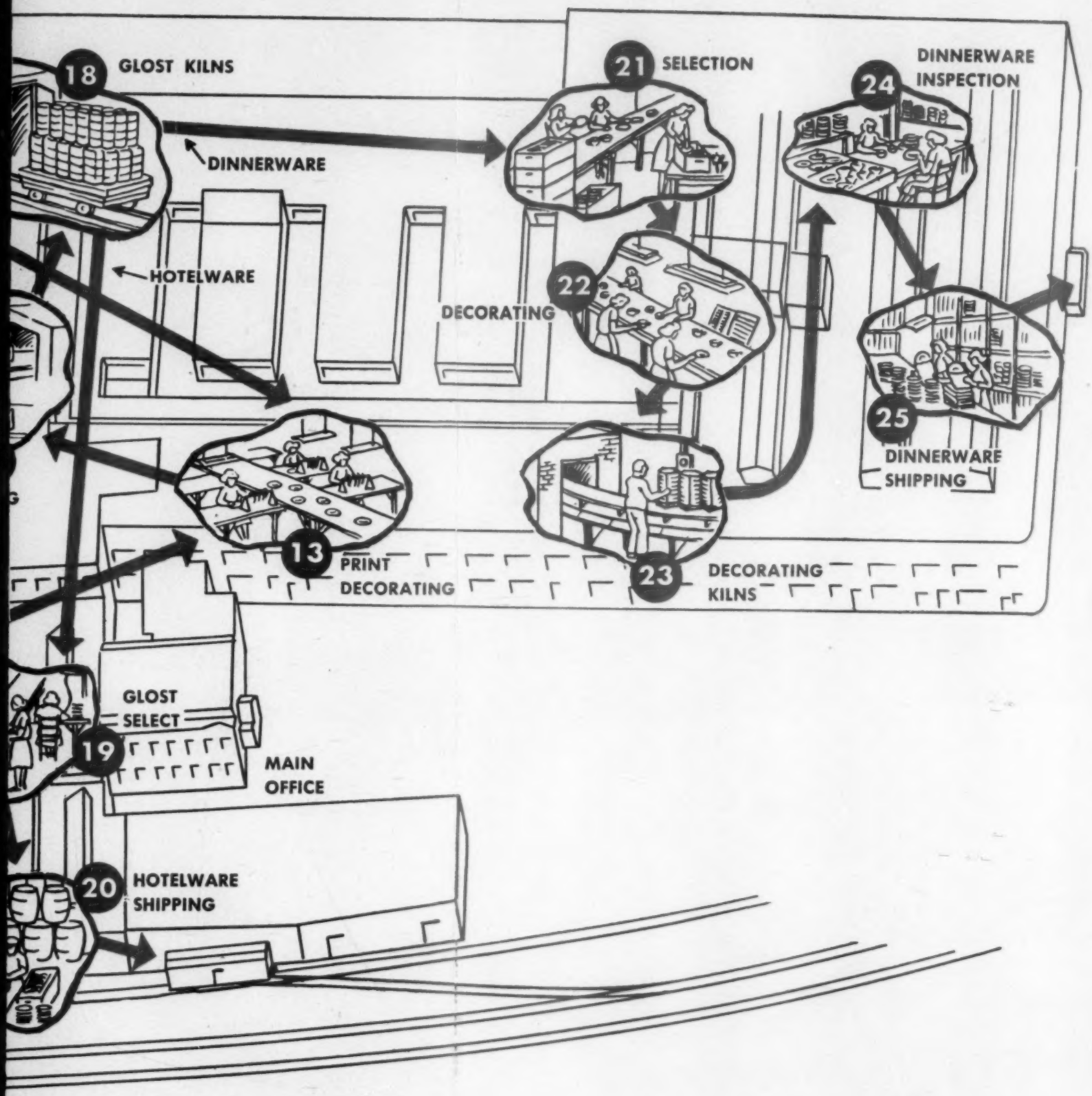

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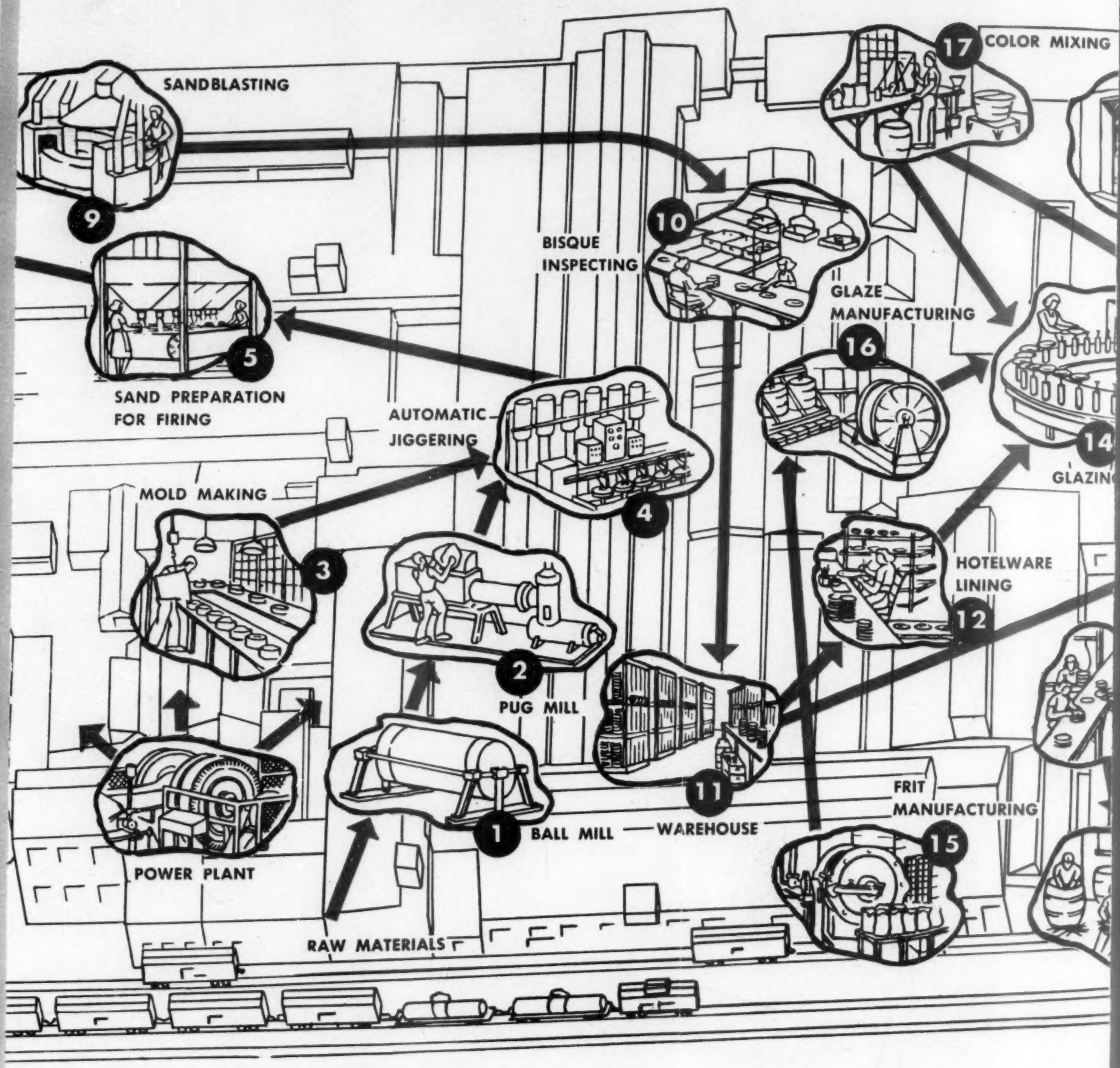
Dinnerware is selected (21) and sent to the dinnerware decorating department (22). Here decorations are transferred from decalcomania to the glazed white ware. Ware is then sent to the decorating kilns (23) and fired. After firing, the ware is inspected (24) by burnishers who add the final touch. It goes then to the dinner ware shipping department (25) where each piece is carefully wrapped and packed.



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IF INDUSTRY EVER HAD TO GO UNDERGROUND

Here are the problems that face management. Highlights from a study of wartime and peacetime experience

Most people agree that industry would not go underground if this country got dragged into another war. For one thing, the cost would be prohibitive. It has been estimated at $500,000,000,000.

For all that, it might be necessary to put a few plants underground. And because that possibility does exist, management should know something about the problems that would be encountered.

Fortunately there is plenty of evidence. Underground plants got a tryout in World War II. By V-E Day Germany had 143. Japan operated a number. Britain experimented with them. So did Sweden. In fact, as shown later in this article, a Swedish underground plant is still running today.

What then are the facts? An examination of available experience brings to light the following:

1. With few exceptions, Germany, Japan, and Italy moved factories underground on the basis of expediency, then enlarged existing caves, mines, quarries, and tunnels. There was almost no advance planning or special construction to fit specific requirements and meet peculiar conditions of underground operation.

2. Working under wartime shortages in manpower, materials, and equipment, our enemies had to omit many desirable underground plant facilities. Their experience leaves us unsolved problems in air conditioning, gas-proofing, dust control, and noise absorption.

3. In general, the most desirable underground sites were those found in the sides of hills or mountains. Such locations had advantages in dryness and relative freedom from trouble with groundwater, whereas those in foothills and valleys were usually wet. They also made installation of sewage systems easier, afforded more adequate ventilation, and usually provided better entrances and exits.

4. Many German and Japanese underground plants were excessively damp. Rapid corrosion and deterioration of equipment, not to mention constant discomfort and illness among workers, were common results.

5. Information on German experience emphasizes the need to provide for underground location of supporting facilities, such as power plants, transportation systems, and storage space. The fact that machines were underground didn't help when Allied bombing interrupted the supply of fuel, power, or materials, and blocked shipments.

Electric power was generally furnished the German plants by existing local facilities and transformed to the desired voltage by underground transformer stations. However, three underground generating stations in the Clausthal grid supplied power to mines and towns in that area.

German experience showed that transmission lines, carrying energy over long distances at high voltage, can be restored to service quickly. But transformers needed to step the voltage down are highly vulnerable to shock from near misses, and cannot be easily or quickly repaired.

German experience also demonstrates need for ample storage space for raw materials and finished products. Such storage should enable the plant to operate for at least two weeks without recourse to surface transportation.

6. All study of underground plant operations to date underlines the need for special planning and engineering. Investigation proves that hurried installations of manufacturing facilities in existing mines or caves brought troublesome problems and left much to be desired from the standpoints of efficient production, proper maintenance, and worker welfare.

Swedish Experience

Some plants have operated successfully underground. Witness the Bolinder-Munktell Company's cave plant at Eskilstuna, a town of less than 50,000 population, 100 miles from Stockholm. This plant was built for wartime production of aircraft engines. Now it produces diesel engines, aircraft engines, tractors, agricultural and sawmill machinery, and machine tools.

Transportation facilities, except for workers, are of comparatively small importance, because finished goods and raw materials can be carried to and from the plant by truck. Railroad lines supply the area. In the unlikely event of all these being cut, water transport is conveniently close by.

Hewn from outcropping rock, this plant was constructed with a general floor level about that of the surrounding country. Parallel bays, 50x100 feet, are connected by transverse passageways. No roof or wall bracing is required. Periodic inspections are made to discover and remove loose rock.

There was no need to waterproof these rock tunnels. Any seepage is carried off by conditioned air kept slightly drier than normal. Humidity can be kept so low that nothing rusts. No rock is visible in the main shops, which are enclosed in an inner shell of composition board painted white. The space between the shell and the rock serves as a return passage for the air conditioning system. Untreated sew-

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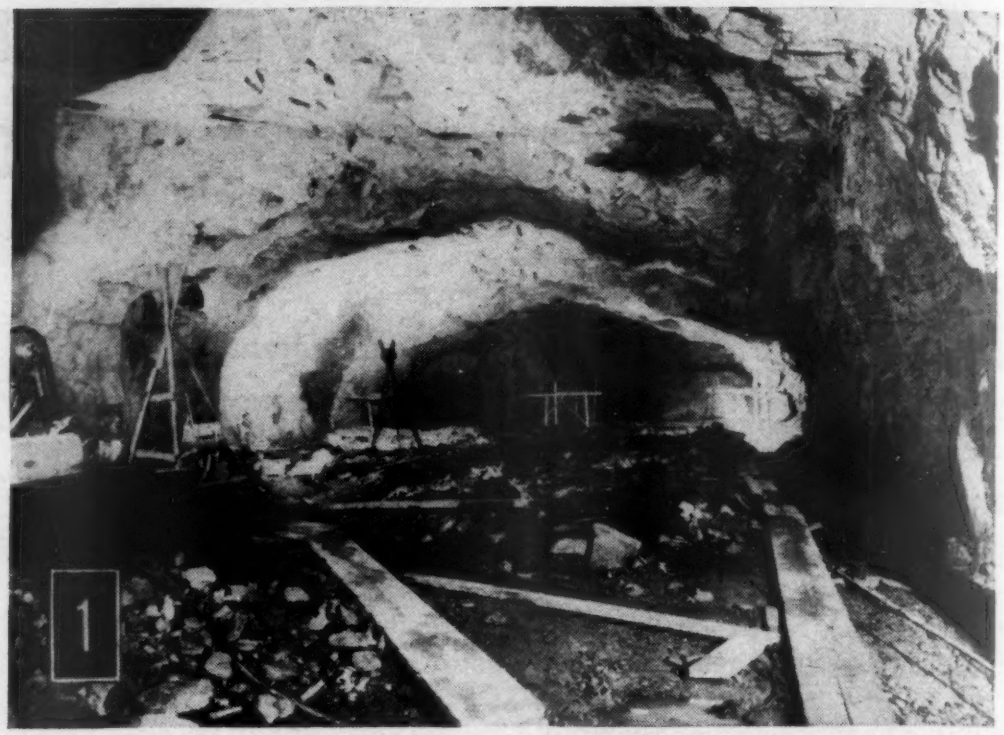
age is disposed of through natural drainage.

The plant has several emergency exits, including natural exits provided by engine test shafts.

Protection was provided against poison gas. Double doors are gas-tight with inner locks between. Special power-driven air conditioning apparatus was installed to take care of gas, with hand-driven pumps in case of power breakdown. No difficulty is anticipated in providing protection against radioactive particles by means of lead baffles in shafts and entrances.

Power supply is from the national utility network. A reserve battery lighting system was installed to provide illumination in case of power failure.



HEWING OUT TUNNEL FOR ONE OF THE WORKSHOPS IN SWEDISH UNDERGROUND PLANT

SAME TUNNEL SEVEN MONTHS LATER WITH BUILDING FRAMEWORK ALMOST COMPLETED

Cooling Arrangements

Cooling, rather than heating, is necessary most of the year. In departments where there is exceptional heat, such as the hardening room, air is cooled by a local system. Special arrangements likewise were made for confining dust to the place of origin.

The composition board shell dampens noise effectively. Storage areas are in the rock close to the shops. No information is available about these areas, the size of the plant, or the number of workers. This number is estimated at 500.

Water is taken from city supply and a plant pumping station, which draws from a deep well. Large storage tanks are situated deep underground in the rock to contain well water. Fire could be fought by closing gas-tight doors and sealing off the air supply.

Lockers and washing facilities are provided in a building at the plant entrance. Toilets are the only sanitary arrangements underground. There is no underground infirmary or first aid station.

Production equipment is all of regular type. None causes any considerable vibration, and noise is no greater than in any surface plant.

Shop layout naturally is conditioned by the rock structure. The 15-ft. aisles give adequate space for machinery and conveyors, but narrow connecting passages prevent really efficient layout. Materials handling equipment formerly consisted of an overhead monorail system and trucks. For peacetime production of tractor engines, roller conveyors also are being introduced in the plant.

Before the experience of working underground, workers were decidedly skeptical. Actually, however, turnover of employees has been no greater than in a normal plant. Less than one per cent of those leaving do so because the shop is underground.

Workers' health has, if anything, improved underground. The dry, constant-temperature atmosphere seems to suit people. No impairment of efficiency has been noted. Such aids as sun-lamp treatment or special rest periods have not been found necessary. Productivity is at least as high as, if not higher than, that at this particular company's surface plant.

Cost Comparisons

Bolinder-Munktell also has surface plants producing the same products and can therefore easily compare costs.

The company knows, for instance, that plant costs run about 15 per cent higher underground, but maintenance costs are lower. The com-

MACHINE SHOP IN OPERATION. ALTHOUGH PLANT WAS BUILT FOR WARTIME USE, IT IS STILL BEING SUCCESSFULLY OPERATED

pany is now quite happy to have this plant to augment its peacetime production facilities.

No Swedish industrialists have shown any sign of going underground in peacetime. Those who were forced to do so during the war were pleasantly surprised to find out how painless it was, both to the budget and to their workers. Since total cost of operating underground plants actually is less in the long run, there seems to be no reason why companies should not be willing to invest in such plants. So far, however, some sort of compulsion seems necessary.

Here then is evidence of both satisfactory and unsatisfactory adaptation of subsurface conditions to manufacturing requirements.

However, this illustration of the Swedish underground plant supplies but a few of the answers to the gigantic and costly possibility of putting America's war potential underground.

Before embarking on such a venture, American management will have to decide these issues:

1. What provisions can be made for the innumerable services needed to support such industry?

2. How will labor supply, transportation facilities, and housing influence location and operation of underground plants?

3. Can plants and personnel be protected from radioactivity?

4. Would industrialists volunteer to locate plants underground in peacetime?

5. Would they be willing to invest in such plants?

6. What shall be the role of government in preparing an underground industry?

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CASES IN WORK SIMPLIFICATION

RENE T. SELVER • EXECUTIVE VICE-PRESIDENT, DUTCHESS UNDERWEAR CORPORATION, OLD FORGE, PA.

1
HOLE IN WALL SPEEDS PACKAGE TRANSPORT

Old Method: Garments came off production lines in paper bags. A machine, located at the end of the production line, automatically tied string around six bags. The tied package was then dropped into a push truck. When the truck was full, two stock boys pushed it 60 feet along the wall between the production and shipping departments, down the 30-ft. ramp to the shipping department (one-half a story lower), and back along the same 60-ft. wall to the shipping area.

New Method: An 18-in. square hole was cut through the wall to the right of the tying machine. When the operator finishes tying the package, she drops it down a wooden chute through the hole. A bin at the bottom of the chute holds the packages for stock clerks to inspect and pack. Two stock boys have been released from the transport job for other duties. The chute paid off its initial cost in less than two weeks in direct labor savings.

2
HALVED TIME TO DISPENSE CLEANING FLUID

Inspectors spread garments over a table which has a frosted glass work surface and is illuminated from underneath. As they inspect garments, they remove soiled spots by rubbing them with a cloth saturated with cleaning solvent.

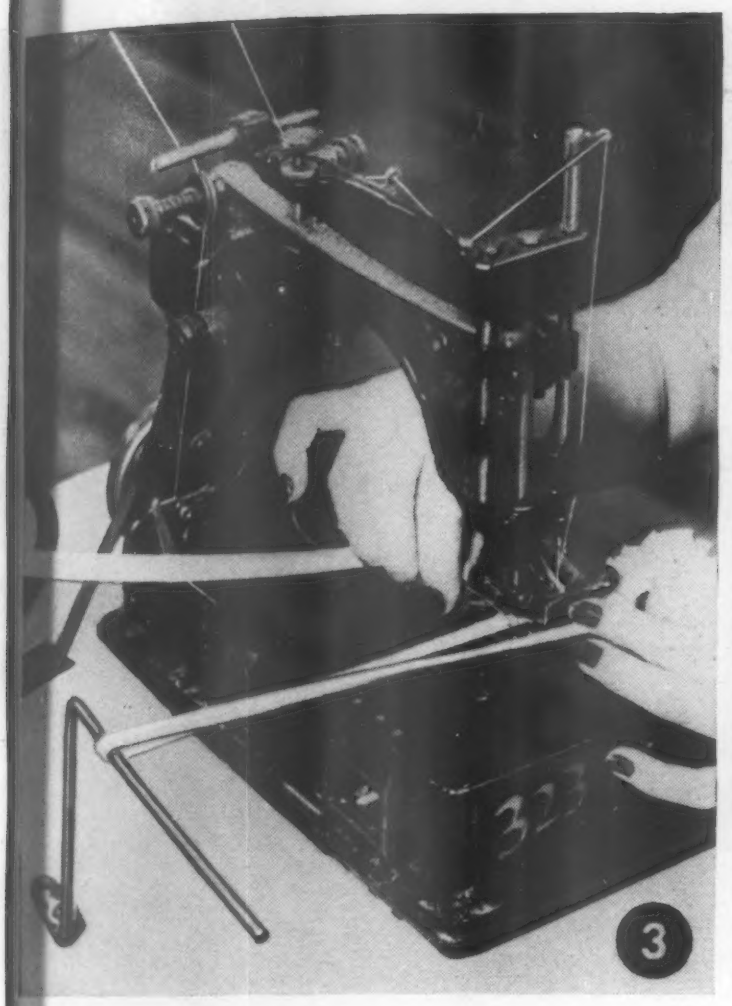
Old Method: The inspector dispensed the fluid from a bottle by applying the cloth to its mouth. It was a two-hand job which necessitated lifting and tipping the bottle and replacing it. The bottles occasionally overturned, with a loss of fluid and time.

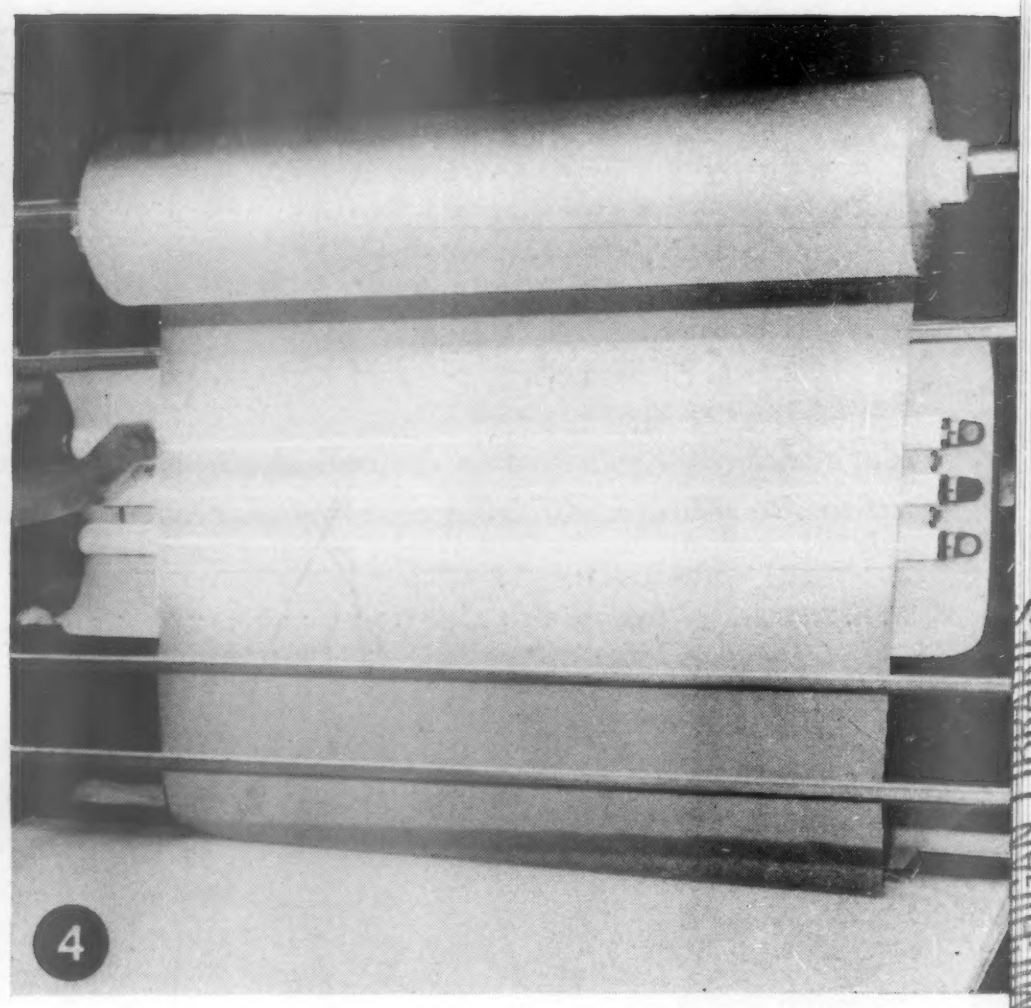
New Method: A tilt-type liquid-soap dispenser, fastened to the lower right corner of the inspection table, holds the fluid. The inspector holds the cloth in her right hand and tilts the dispenser over it. It is as simple as that. As a result of this simple innovation, inspection time has dropped noticeably; more garments are checked by existing inspectors; and solvent is conserved.

3
FIXED MEASURE FOR CLOTH TAPE GIVES UNIFORM LENGTH

Old Method: Cloth tape for undergarments was unspooled to estimated lengths by the operator. First, she sewed the loose end to the garment, then judged the tape's

5. Dutchess Underwear Corporation





length, cut it, and sewed the other end. The method was slow as well as inaccurate.

New Method: Operator feeds the tape from the spool, having grasped the free end with her left hand. She runs it under the sewing arm, around the presser foot, across the machine to a piece of iron rod about 5 inches from the machine. The ¼-in. rod, flattened at one end, was drilled through and screwed to the table after being bent to shape as shown in the photograph.

Upon reaching the rod with the tape, the operator loops it around the rod and pulls the free end back to the presser foot.

Then, with her left hand, she also grasps the garment at the point where the tape will be attached. Her right hand grasps small shears which cut the tape near the presser foot. The tape ends are then sewn to the garment.

Although the description of this operation is necessarily long, the complete operation is performed in a fraction of the time needed with the old method and tape measurement is absolutely uniform.

4
CLOTH SPREADING WITH INSPECTION LIGHT CUTS WASTE

Old Method: A dolly, used to spread cloth, was pushed back and forth along the spreading table. Flaws in the cloth often escaped the spreader's eyes as he laid it out on the long table. As a result, the cutters, cutting to count, turned out garment sections with imperfections. Since the cloth had been cut for a specific number of garments and no inspection followed cutting until after garments were assembled, the loss in garments with bad cloth ran high.

New Method: A fluorescent fixture containing three yellow tubes and extending the width of the dolly was installed on the dolly behind the cloth. When the spreaders lay out the cloth, they inspect it for flaws as it passes the lighted fixture. When a flaw is found, the spreader places a piece of colored tissue paper over it and at the same time puts a tag at the outer edge or selvage of the cloth.

Now, when the cutters come to one of the colored paper markers, they remove the damaged piece or pieces of cloth. The imperfect pieces are counted and replaced with good pieces. The cloth with flaws is generally held until there are enough pieces to assemble second grade garments. This means that no garments on the regular runs are lost after assembly because of cloth flaws. This method of pre-assembly inspection has cut defects in finished garments from 25 to 30 per cent. The number of seconds is greatly reduced, and the cost of labor spent on garments with flaws in the cloth has been practically eliminated.

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BETTER PRODUCTION CONTROL WITH ALL CHARTS IN ONE PLACE

More than 200 production control charts and graphs. All up to the minute. All in one room—for everyone to use

W. H. SNYDER • MANAGER, PRODUCTION CONTROL ROOM
THE GLENN L. MARTIN COMPANY, BALTIMORE

PRINCIPAL objective of the production control room at The Glenn L. Martin Company is to provide a basis for control of the numerous activities in the manufacture of aircraft. Corrective action is not within the scope of control room personnel; it is their job to see that the charts reflect the facts as reported to them.

The control room is open not only to management and supervision but also to all employees of the company and to representatives of the Army, Navy, and commercial airlines. This "open house" policy reflects management's belief that informed employees are the best employees; that the store of information available in the control room is a time-saver for any employee seeking current facts for future planning or historical information; and that frankness in its relationships with its customers is good business.

The control room is approximately 18 feet wide and 46 feet long. Along two of its walls and on three partitions built across the room are hung hinged plywood boards 48 inches square. Taped to these boards are more than 200 charts and graphs which show the status of production, beginning with the release of engineering drawings and ending with delivery of the completed airplane or component parts.

The charts are kept as simple in format as possible and are of three basic types—*bar charts, line graphs,* and *pictorial charts.* The information shown is of two kinds—*scheduled performance* and *actual performance.* The scheduled performance lines are based on engineering release schedules or on master production schedules.

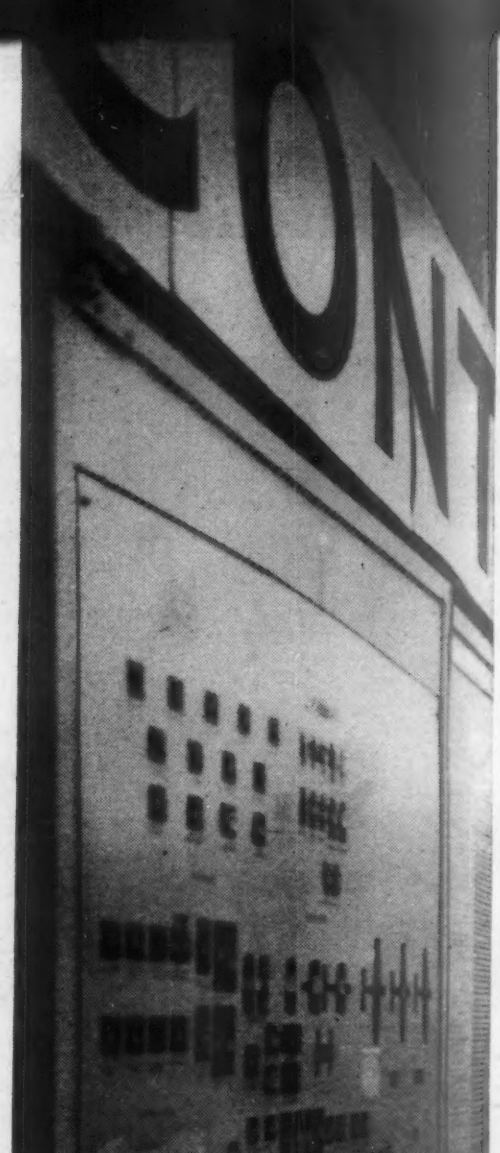
Actual performance lines are posted from reports, most of which are prepared and forwarded to the control room daily, from the departments responsible for the activities covered. Having this information accumulated by the responsible department rather than by the control room personnel serves three purposes:

1. It keeps the personnel of all departments aware of the necessity for knowing the over-all status of their work and assures management that this awareness exists.

2. Responsibility for the accuracy of the information is clearly established, and disputes as to the accuracy of the status as displayed in the control room are virtually eliminated.

3. The cost of operating the control room is held to a minimum. Only two people are needed.

The charting of the progress of all airplane models or contracts follows a similar pattern. Production, or long-run projects, however, are charted in greater detail than those involving a small number.



MARTIN PRODUCTION CONTROL ROOM

Release of Engineering Data. The first activity covered by the control room is the release of engineering information to the manufacturing division. The planned or scheduled release of engineering is plotted in blue pencil on a graph, in terms of estimated airframe weight. As the drawings are released to the production planning section, the estimated weight which they represent is noted on a transmittal sheet which accompanies them. A copy of every transmittal or "job sheet" is forwarded to the control room, and the estimated weight is posted daily to the graph in red pencil.

Subsidiary graphs, usually about 50 in number, are maintained in conjunction with the over-all re-

CHARTS, KEPT AS SIMPLE IN FORMAT AS POSSIBLE, SHOW PROGRESS OF ALL PROJECTS FROM DRAWING BOARD TO SHIPMENT

lease graph. Each of these graphs covers a major assembly or installation called a "control point." Typical control points are center wing spars, outer wing frame, fuselage nose section, and landing gear. A blue *schedule* line and a red *release* line are shown on each graph, posted in terms of percentage.

Engineering Performance. A companion graph is maintained, showing engineering department performance and efficiency. The graph shows the engineering man-hours expended per pound of airframe weight released. *Scheduled* performance is plotted in blue; *actual* performance is plotted in red. These charts are used by the engineering department to check its progress, by management, and by the manufacturing division to determine the volume and nature of engineering information it will receive in the immediate future.

Availability of Materials. Procurement of materials, availability of detail parts, and completion of assemblies are controlled by means of bar charts. Control points are listed at the left; ship numbers across the top of the charts. Strips of blue and red celluose tape, previously covered with white tape, are extended horizontally across the chart; one blue and one red tape for each control point. Scheduled and actual performance are posted by peeling off the white tape and exposing the blue and red tapes. This method permits quicker and neater posting than would be possible if the colored tapes were posted to the charts in small pieces as required, and results in a more uniform appearance than if the bars were filled in with colored inks or pencils.

Wherever the red tape is shorter than its corresponding blue tape, the control point is behind schedule. These danger points can be picked out at a glance and any necessary expediting action taken.

Assembly Positions. A quick picture of conditions on the main assembly floor for any airplane model is provided by the positional chart, which is pictorial in form. Each assembly fixture or position on

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the assembly floor is represented on the chart by a black block or a silhouette in the actual shape of the assembly or airplane. There is also a line of airplane silhouettes for ships being ground tested and flight tested, those ready for customer acceptance, and those accepted.

Daily reports listing the movements of assemblies or airplanes on the production line are posted to the chart by moving colored tags, each tag bearing a ship number. The tags are of different colors—*white* for ships or assemblies on schedule; *green* for those ahead of schedule; *red* for items behind schedule; and red tags with white horizontal stripes point out assemblies on which work has been stopped as a result of shortages of parts. Danger points are readily spotted by tag colors.

Assembly Time Cycles. Among the most frequently used charts in the control room are the major assembly time cycles. These are bar charts, with ship numbers listed vertically at the left and right margins, and date strips printed horizontally at top and bottom.

There is a chart for each major airplane section, such as center wing, forward fuselage, center fuselage, and so forth, and for final assembly, ground test, and flight test. Opposite each ship number a strip of black tape is extended between the scheduled starting date and the scheduled completion date as set up in the master production schedule.

Daily reports show the ships for which the major assemblies have been started or have been completed. When an assembly begins, a strip of red tape is started on the chart for the particular ship and under the proper date. Until the assembly is completed, the red tape is extended each day. If the red tape extends beyond the black tape, the assembly is behind schedule.

Master Change Records. In the control room, charts similar in design to those used for control of procurement of materials and completion of assemblies are maintained for the control of MCR's. Listed at the left are the MCR numbers and descriptions; across the top of the chart are shown the ship numbers. A square patch of blue tape is attached opposite each MCR number and under the number of the first ship in which the change is to be incorporated in the production line. If incorporation cannot be effected in the line in all the ships of the contract, and if incorporation is required in all ships, kits of the necessary changed parts are shipped out for installation in the field. These are called "service changes" and are indicated on the chart by a yellow square of tape instead of the blue.

The production planning section conducts the routine follow-up on MCR's and sends reports on scheduled incorporation points and on actual incorporations to the control room. When a change has been incorporated in the first lineship affected, a red tape is posted under the blue on the chart. When kits for service incorporation have been shipped, the red tape is posted under the yellow.

The foregoing types of charts are maintained for each production contract. In addition to them, a variety of charts are kept which are more general in coverage.

Fabrication of Detail Parts. A line graph is used to indicate the issuance of parts fabrication orders to the detail manufacturing department. At the beginning of each month, the master planning section prepares and issues a forecast of the number of orders that will be put into the shop during the month, the number of orders the shop will complete, and the number of orders that will comprise the active backlog of work in the shop. This forecast is based on the number of parts that will be required to meet assembly schedules on the various contracts and also on a physical inventory of the orders active in the shop.

Continued deviations in the actual performance from the forecast indicate a need for increased facilities or manpower in the shop or the advisability of subcontracting work, whenever the active backlog runs steadily higher than forecast. If the backlog runs lower than forecast, action must be taken either to increase the flow of work to the shop or to shift personnel to other departments. This chart aids in anticipating manpower needs in the detail manufacturing department, and also gives warning of possible shortages on the assembly floor.

Purchase of Materials. Purchase orders for materials are placed by the purchasing department, upon authorization, through the medium of purchase requisitions from material control section. Each day the purchasing department reports to the control room the number of requisitions received from material control department, the number for which purchase orders have been placed, and the backlog or requisitions still to be worked.

These figures are posted to a line graph like that used for shop fabrication orders. Requisitions received are entered with a *blue* line; those ordered, in *red;* the backlog, in *green.* Abnormal increases or decreases in the backlog point out the need either to increase the flow of requisitions or to add to the personnel and facilities for handling them.

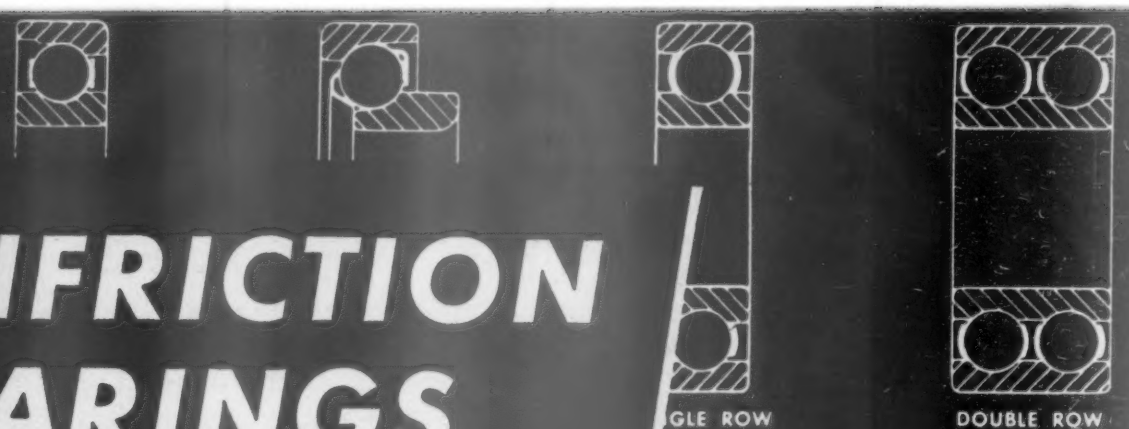
Scrap Costs. The scrapping of parts and materials in the manufacturing process requires close control. Vertical bar graphs for each division and department show the actual replacement cost of parts scrapped by each department. The material review section of the quality control department establishes the department responsibility for all parts which are to be scrapped. The estimating section determines the replacement cost of these parts, compiles the total scrap charges against each department, and sends a report of these charges to the control room. The trends in scrap costs are closely watched by management and supervision, and corrective action is taken when increases occur or continued high costs exist. On the graphs for the major divisions of the company, bars are plotted to show the cost of scrap for every 1000 direct labor hours worked, for the information of management and supervision.

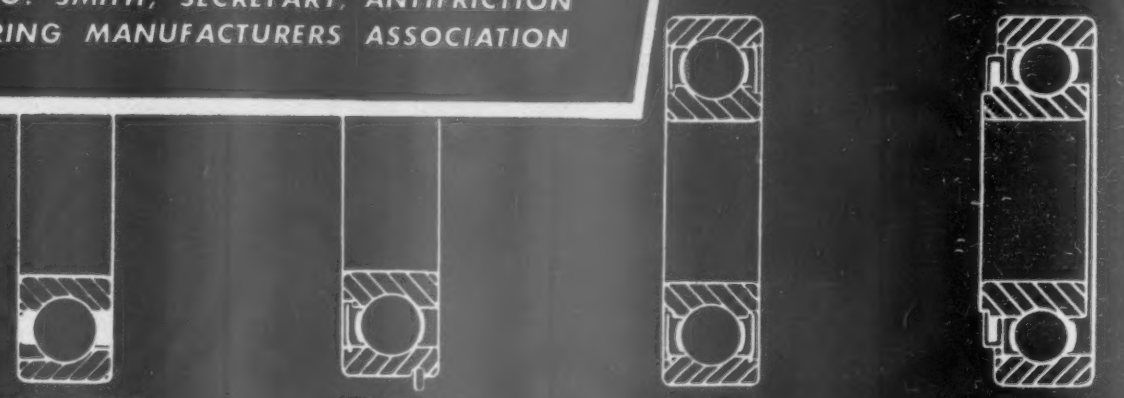
★ ★ ★

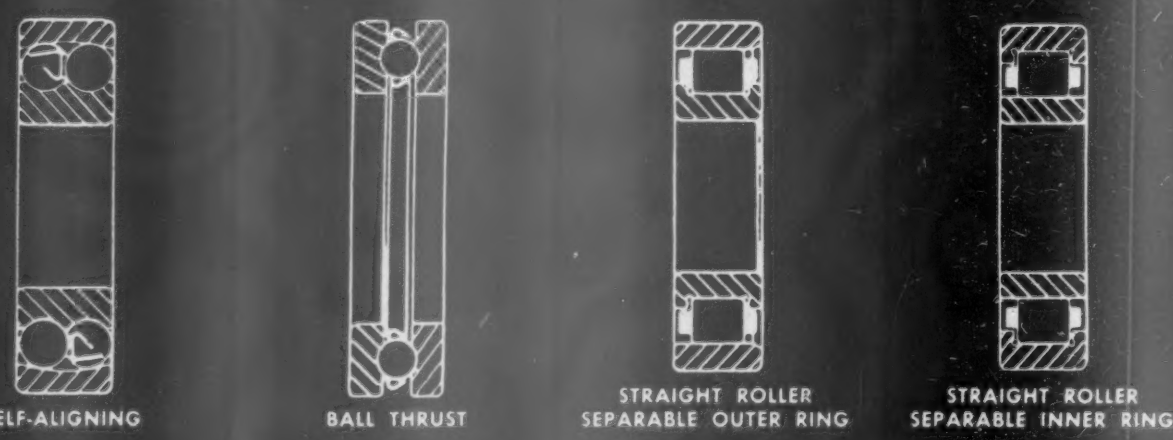
The possibilities inherent in the maintenance of the control room are almost limitless. As a result, its store of information and the charts with which it aids in production control are continually being broadened to embrace new activities.

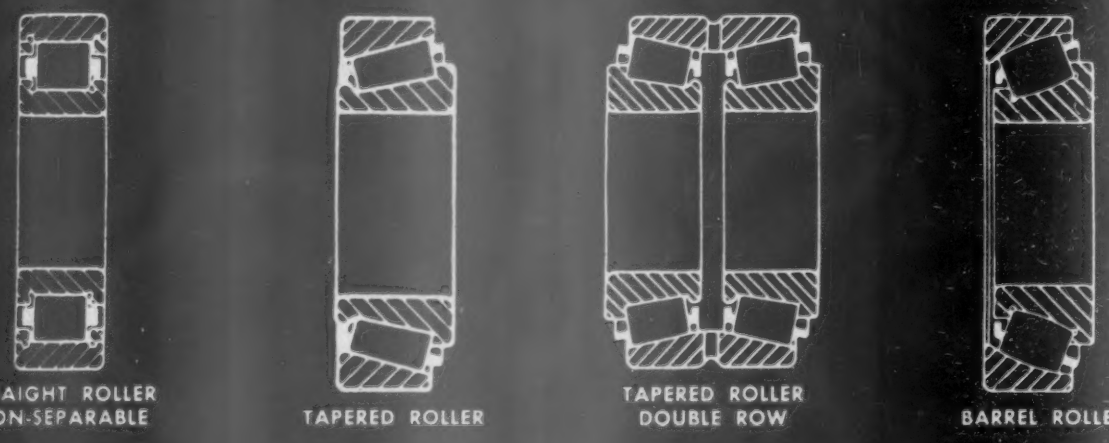
ANTIFRICTION BEARINGS

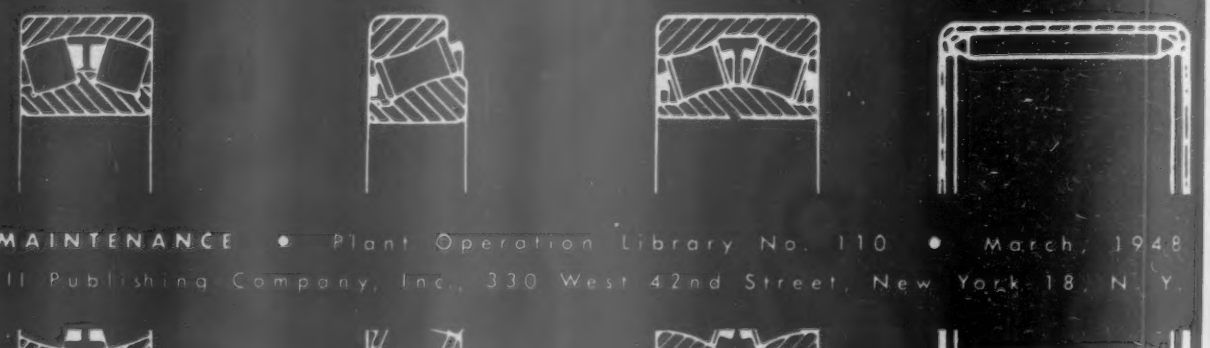
H. O. SMITH, SECRETARY, ANTIFRICTION
BEARING MANUFACTURERS ASSOCIATION











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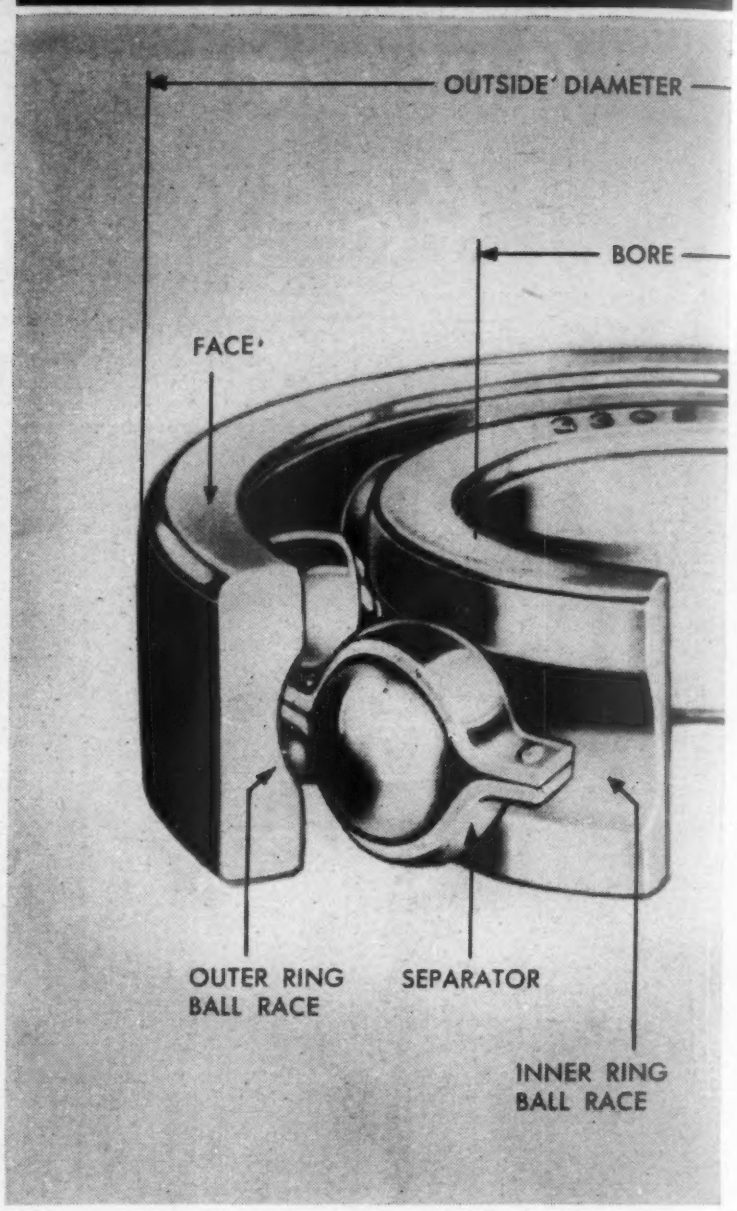
ANTIFRICTION



TYPES OF

VIRTUALLY every piece of machinery in a modern industrial plant depends on ball or roller bearings or both. Failure of even one bearing is sufficient to stop a piece of equipment, frequently an entire operation. Therefore a practical working knowledge, at least, of all the basic antifriction bearing types is essential. Included, of course, are the methods of selecting, installing, and maintaining the bearings.

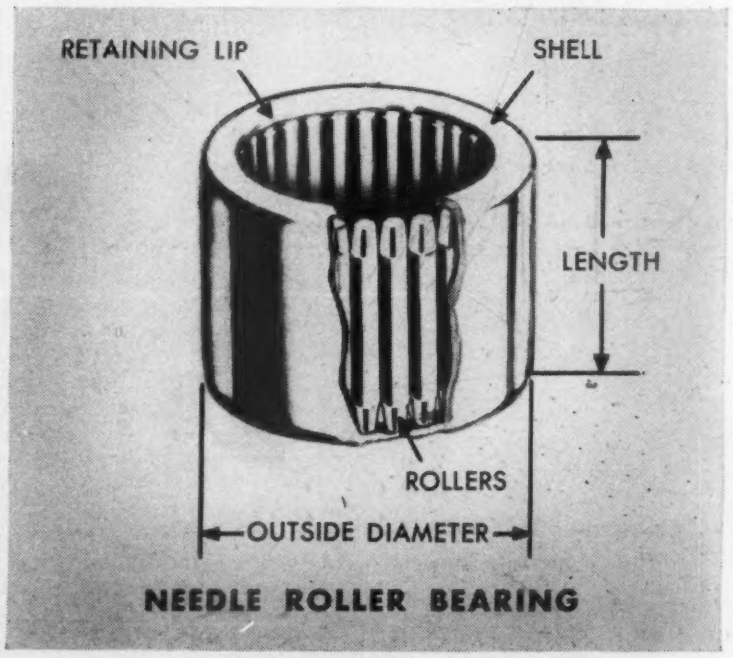
Those who have a bearing problem to solve are confronted with what seems to be a staggering array of types and sizes. The lettering in this text corresponds to that adopted by the Anti-Friction Bearing Manufacturers Association in its standard industry numbering system. It will apply to all types of assemblies and will in time eliminate the radical differences that now exist between the codings of different manufacturers.

For the present, all manufacturers in the association have agreed to put the new coding in their catalogs, use these numbers on cartons, and eventually put them on the bearings themselves. This changeover will be gradual and will affect the bearing catalogs first, later the cartons, and last of all the stampings on the bearings.

Basically, the fundamentals governing bearing selection are load (radial, thrust, angular); speed; and operating conditions (dirt, water, heat, corrosive or abrasive atmospheres). It is possible today to produce an antifriction bearing that will meet virtually any requirement.

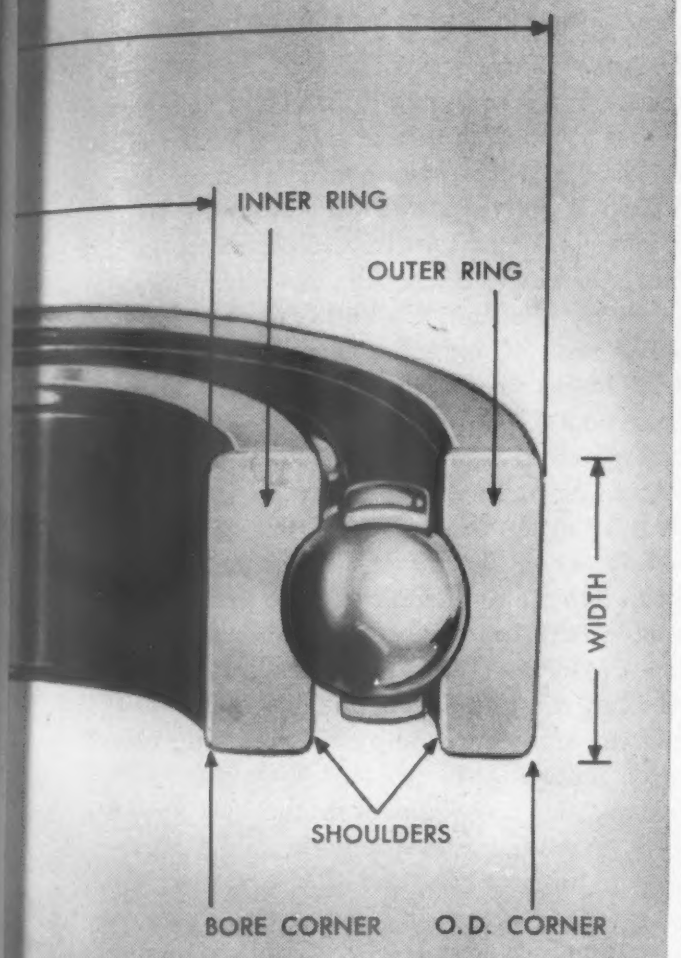
Although each of the basic ball and roller bearing types is designed for specific load and speed factors, there are hardly any two applications in a piece of machinery that will have precisely the same operating requirements. In industry, there are thousands of applications in which either ball or roller bearings can be used. Exceptions include such conditions as unusual thrust or radial loads, super speeds, tiny or mammoth sizes. Examples: Because of operating conditions, roller bearings are the only practical bearings for railway car journal boxes. On the other hand, the size of the operating space makes ball bearings the only practical bearings for certain tiny electrical instruments.

In principle, ball bearings are designed for medium radial and heavy thrust loads; straight roller bearings for heavy radial loads and very light thrust; tapered roller bearings for all combinations of radial and thrust loads. However, engineers are able to make special combinations and adjustments that give these types an even broader range of application.

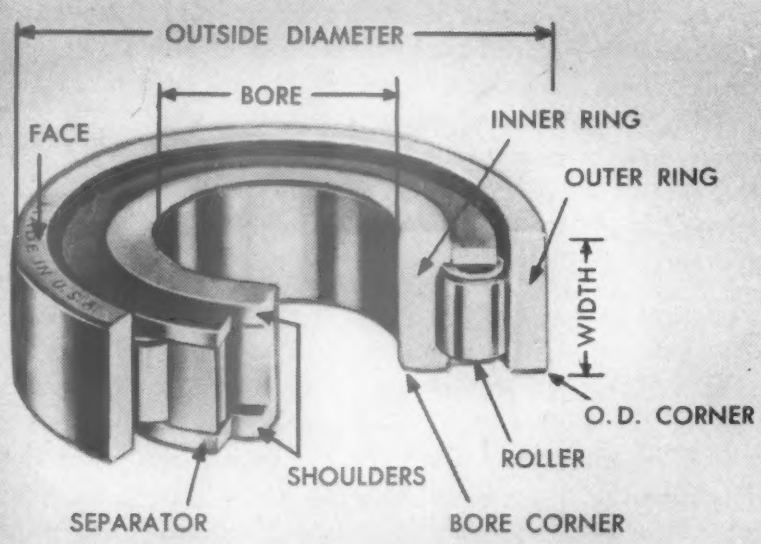


NEEDLE ROLLER BEARING

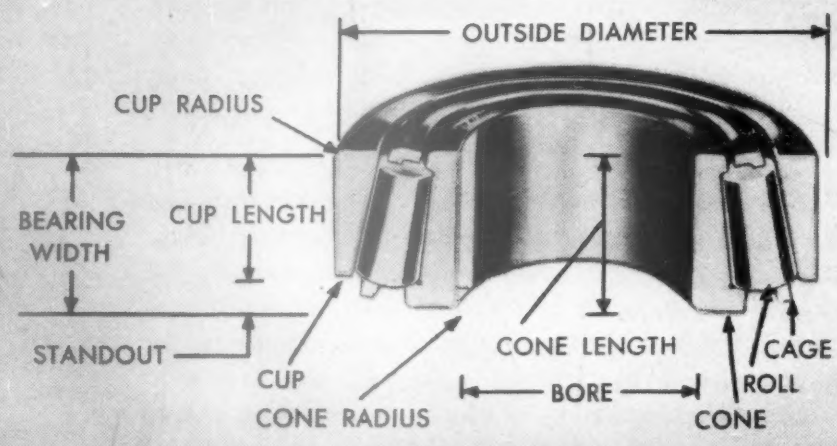
BEARING PARTS AND THEIR NAMES



BALL BEARING



STRAIGHT ROLLER BEARING



TAPERED ROLLER BEARING

BEARINGS AVAILABLE

BALL BEARINGS

SOME ball bearings take heavy radial loads, others thrust loads, and still others a combination of radial and thrust loads.

Annular ball bearings have a groove or annulus in the inner and outer rings in which the balls roll. The radius of the race groove is slightly larger than that of the balls and enables the raceway to provide an elliptical contact area between race and balls. Result: Greater radial-load capacity than would be possible with a flat raceway, and ability to carry thrust as well as radial loads.

Deep-groove ball bearings (BC) are the most popular single-row type and the most flexible for general use. Other descriptive names are Conrad assembly, non-filling slot, no-notch, and continuous raceway. This type is considered a radial-design bearing and, because it has no filling notch, carries high thrust loads in either direction and is able to take small angles of misalignment. *Applications: Moderate radial loads, moderate thrust loads in either direction, high speeds, combined radial and thrust loads.*

Maximum-capacity bearings (BL) are of the single-row radial type having a filling notch, filling slot, or loading groove. To equip this type for high radial loads, it has the maximum number of balls that can be used and still have space for a retainer. To do this, it is necessary to cut a notch in one side of each race through which the extra balls are inserted. The bearing is not designed for high thrust or thrust load alone because the notch removes part of the raceway's sides. *Applications: Heavy radial loads, moderate thrust loads in either direction, combined radial and thrust loads, moderate speeds.*

CONTINUED ON NEXT PAGE

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Double-row ball bearings (BD, BE, BJ, BG) have inner and outer rings with two grooves and two rows of balls. Such a bearing is slightly narrower and has slightly less radial capacity than two single-row bearings put together. Contact of the balls is at an angle, as in the angular-contact bearing described later. The double-row bearing has a thrust capacity equal to one single-row bearing. *Applications: Heavy radial loads, thrust loads in either direction, great axial and radial rigidity, moderate speeds, combination of heavy radial and thrust loads.*

Angular-contact bearings (BH, BAL, BAM, BAH) are also known as the radial-thrust type. They have an outer ring with a high shoulder on one side and a shallow one on the other side. This design makes it possible to put the maximum number of balls in the bearing. Because the ball contact is at an angle, the bearing can take a high thrust load in one direction, but none in the other. It is used where thrust is all in one direction and radial load is heavy. It is commonly mounted with another angular-contact bearing on the opposite end that carries equal thrust load. *Applications: Heavy radial with heavy thrust loads, heavy thrust loads in one direction, great rigidity, loads where adjustment is required, high speed.*

Duplex bearings are produced by mounting two single-row angular-contact bearings together as a unit. This type is sold in matched pairs, back-to-back, face-to-face, or in tandem. Where shaft deflection must be held to a minimum and great rigidity and precision are required, either of the first two arrangements usually is adopted, as in machine-tool spindles. For example, back-to-back mounting is required to compensate for shaft expansion if the bearing floats in the housing. The tandem mounting is used where extreme thrust capacity is desired, with minimum axial movement. *Applications: Heavy radial loads, heavy thrust loads in either direction, extreme axial rigidity, great radial rigidity, high speed.*

Self-aligning bearings (BS) have an inner ring with two raceways, as in a double-row design. The outer ring has a spherical inner surface so that balls and inner race can pivot about the bearing's center. Thus the balls can choose a path on the outer race to compensate for misalignment between shaft and bearing housing. This bearing is made in two widths. The standard series has the same width as a single-row design; the wide series has the width of a metric double-row bearing. *Applications: Loads where shaft or housing may be out of line, moderate radial loads, light thrust loads, moderate speeds.*

Thrust bearings, also known as washer thrust bearings, have races resembling flat washers with the balls rolling in concentric grooves in each washer. This bearing has no radial capacity and is designed to handle heavy thrust loads in one direction only. It is not recommended for high speeds because centrifugal force causes unsatisfactory ball operation that often leads to bearing failure.

An alternative for high-speed thrust loads is the angular-contact bearing. Thrust bearings are made with and without retainers, and some have self-aligning seats. *Applications: Maximum thrust in one direction, axial rigidity in one direction, moderate speeds.*

Special designs. Many special designs have been added to the basic types to control lubrication, to assist in mounting, and to fit a number of other special conditions. The *plate-shielded bearing,* for example, has a thin metal strip or plastic plate swaged into a groove in the outer ring, and runs with close clearance in a recess on the inner ring. Such bearings have a plate shield on one or both sides. While this does not provide a positive seal, it excludes large particles of foreign matter, keeps grease in the bearing, and reduces the lubricant flow through it.

A double-row design is made with one or two plate shields and is wider than the standard.

Another variation in the standard designs is the *felt-seal bearing,* which has a felt washer that is supported between two metal stampings fixed in the outer ring and rubs on the inner ring. This increases the bearing's length somewhat, but makes for a more positive seal than the plate shield.

Other seals use labyrinths, slingers, synthetic rubber, and other materials to prevent leakage.

A ball bearing can have one or both sides sealed, or have a seal on one side and a plate shield on the other. To keep lubricant in and dirt out, the felt-seal design is used where the plate shield cannot handle these functions adequately. The term "snap ring bearing" indicates an assembly that has a flat spring snapped into a groove on the outer ring of the bearing. This snap ring fits between the bearing housing and cover plate to position the shaft, and saves machining of a housing shoulder. The most popular application is a single-row ball bearing with snap ring and plate shield for automotive transmissions.

ROLLER BEARINGS

ROLLER bearings are divided into two distinct classes according to the type of roller used—tapered and straight. And straight roller bearings are divided, in turn, into cylindrical, journal, and needle roller types. Within each class is a range of designs and variations suited for a variety of applications and again, as with ball bearings, there is broad flexibility in selection.

TAPERED ROLLER BEARINGS

All working surfaces in this type of bearing, including the cup (outer race), the cone (inner race), and rollers, are tapered so that lines through them intersect the shaft axis at a common point, the apex on the axis of the bearing. This basic geometric principle assures true rolling motion. A shoulder or flange on the bearing's inner race keeps the rolls properly aligned. And, because of the tapered construction, this bearing has high thrust capacity in one direction as well as high radial capacity. Thus any radial load creates a thrust reaction in one direction which must be taken up by another tapered bearing mounted in

opposition. For this reason, tapered roller bearings are almost always mounted in pairs, and are then able to take thrust load in either direction.

Single-row. The most popular design of tapered roller bearing is the single-row type which includes a single cup and a single cone. The tapered construction thereby enables the two bearings to be brought together laterally to provide any desired degree of running clearance between the raceways. This design must be mounted in opposing pairs, since it takes thrust in one direction only and has a thrust reaction in the opposite direction when a radial load is imposed. This type is used for heavy radial loads and/or heavy thrust loads in one direction at moderate speeds.

A variation of this single-row bearing has a flange on its cup that positions the bearing in its housing and thus eliminates the need for a shoulder. This aids in boring cup seats at each end of the housing that are aligned with each other, since it is possible to bore both seats in one operation. Such construction is especially popular for machine-tool spindles and provides a flange strength greater than the bearing's thrust capacity. It is also used where space limitations prohibit housing shoulders and where it is desirable to through-bore the bearing's housing.

Double-row. This bearing consists of a double cup having two raceways and two single cones, which make it possible to handle thrust in either direction in some bearings. In addition, there is ample clearance between the two single cones to permit any desired adjustment. Applications include extra-heavy radial loads, heavy thrust loads in either direction, conditions under which bearing must float in its housing, where extreme axial and radial rigidity is required, and for moderate speeds.

An alternative to the double-row tapered bearing for similar applications is the NA or *non-adjusting* bearing. The same double-row construction is used, but the single cones are wider so their faces butt together. There is therefore no room for adjustment, and internal clearance is determined at the time of manufacture. Applications are where bearings are not to be adjusted when they are installed in the machine or replaced in service.

STRAIGHT ROLLER BEARINGS

The straight roller bearing is the parent of all other variations of roller bearings developed in the past 100 years. In this group there are three major types—*cylindrical roller bearings* with rollers whose length and diameter are about equal; *journal roller bearings* whose rollers are much longer than their diameter (rollers can be solid or a hollow spiral wound from a strip of steel); and *needle roller bearings,* which have needle-like thinness in relation to their length and generally do not have a cage or separator.

Cylindrical roller bearings. It is interesting to note that both the cylindrical roller bearings and single-row ball bearings in the metric series usually have the same external dimensions and are interchangeable as far as dimensions go. However, as with all straight roller bearings, these bearings are suitable for radial loads only, or for light thrust loads where special shoulders are provided. The standard metric design (RN) has a tubular outer race without lips or shoulders. The inner race has lips to guide the rollers. In this design, the inner race positions the bearings on the shaft, but the bearing can float in its outer race to compensate for shaft expansion.

One modification of this design (RU) has rollers guided by lips on the outer race, the inner one being a straight cylinder. In this way the outer race positions the bearing in its housing, and the inner one permits float to take care of shaft expansion.

Another bearing (RF) has one lip on its outer race and two on its inner, limiting shaft movement to one direction but allowing the same radial load capacity.

Another variation (RC) has two lips on the inner and outer races to position the shaft in both directions. It has fewer rollers than the standard bearing and consequently less radial capacity. In the full roller design of this type (RK), the outer race inside diameter is fitted with snap rings that keep the bearing from coming apart. The full complement of rollers gives this type of bearing greater capacity than a standard design, but the absence of a retainer limits its speed.

Journal roller bearings. Two or three separate units make up the typical journal roller bearing—an outer race, a roller assembly, and an inner race. The inner race is often omitted and the rollers run directly on the shaft. The outer race is cylindrical and may be split or solid. The roller assemblies are made up with either solid or spiral rollers. The cage is simply a pair of end plates with rigidly connected spacing bars between them.

Probably the most economical type of journal roller bearings is the *spiral* or *wound-roller* type (JW and JV) with an unground split outer race. It is used where heavy loads must be carried but wide tolerances are allowed—for example, in factory trucks; on conveyor idlers; on the axles and shafts of slow-moving, heavy-load equipment where precision is not a factor and cost does not justify a more finely finished product. Spiral roller types also are produced with solid inner and outer races finished to close tolerances for various applications in machine tools, motors, and gearcases where a higher degree of accuracy is essential.

Wound or spiral rollers are made from a rectangular steel strip wound into a helix to form a roller. The cage consists of two end rings connected by a set of spacing bars. When the bars pass between the rollers, the assembly is called a bar-between type (JW). When the bars pass through the center of the spiral rollers, it is called a bar-through assembly (JV).

Solid rollers are made with trunnion ends that fit into holes in the end rings to keep them in place. The assembly is held together by the bar-between method in which the bars pass between the rollers. It is not necessary to have a bar between the pairs of rollers, so bearings are sometimes designed with bars running between groups of rollers.

Solid outer races in such bearings are hardened, and ground cylinders with oil holes are provided to facili-

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tate lubrication. The split-type outer race is made of a planished steel strip rolled into shape with either semi-hard or cyanided glass-hard finish. Its open joint, with an outward spring, forms a *V* so the rollers pass over it without shock or noise. Pressing the race into the housing closes the joint so that outward tension holds one in the other.

In addition to the various types of journal roller bearings made to fractional dimensions, there are also heavy-duty series made with metric bores and metric outside diameters. They have solid outer and inner races and can have either spiral or solid rollers.

Needle roller bearings. Like other types of straight roller bearings, needle bearings are designed for radial loads. They have a light cross-section compared with other roller bearings, and are especially useful where radial space is limited. Needle bearings are available with a hardened and ground inner race (NAB, NAC, NAD, NAE, NAG, NAH, NAJ, NEB), or without the inner race (NAA, NAF, NEA). The latter may be used directly on a hardened and ground shaft. Most of these bearings have an oil hole in the outer race, and some types have a groove for a snap ring.

It is well to remember that there are a vast number of types and sizes of straight roller bearings, and to use extra precautions in ordering replacements. In specifying the type, the following information is essential: (1) Manufacturer's name, (2) bearing number (if possible), (3) shaft size, (4) bore, (5) outside diameter, (6) width, (7) number and diameter of rollers, (8) type of construction, such as retainers, lips, races, oil holes, snap rings, and other distinguishing features.

When You Order Bearings

The job of identifying and understanding the meaning of all the various codings on ball and roller bearings is not the problem of the maintenance engineer. His interest normally goes no further than getting the right bearing to do a specific job. In most instances, the right bearing turns out to be merely a replacement of the one that is no longer usable. In such cases, he has only to copy the manufacturer's code numbers without necessarily understanding them, and the right bearing will be delivered. If a change in design or operating conditions requires an entirely different bearing, then a bearing service man should be consulted

MAINTENANCE OF BEARINGS

IN THE SELECTION, maintenance, and replacement of all types of antifriction bearings, a few "life saver" suggestions may help a plant operating man save his company many thousands of dollars a year. First, consider the importance of knowing exactly where and in what machinery you have antifriction bearings. In any plant, new equipment is always mixed with older equipment—older motors or overhead pulleys, for example, which may have plain bearings. To treat an antifriction bearing the way you would a plain bearing, or *vice versa,* is the easiest route to bearing troubles.

In spite of the fact that any modern plant may have a great many antifriction bearings operating in a multitude of mechanical equipments, too many maintenance mechanics are still unaware of the need for according the proper treatment to each type of bearing. A good example is in the lubrication of antifriction-bearing motors or generators.

Too often the grease plug at the top of the unit is removed and the lubricant put in without removing the plug at the bottom to allow the old lubricant to flow out. Thus, without drainage, the lubricant will expand from heat and overflow into vital parts of the motor, while the bearing will be running on a partially diluted and worn-out grease.

The error arises from assuming that antifriction bearings consume lubricants the way plain bearings do and thus (like plain bearings) require no drainage plug. Decals marking such drainage plugs, or printed instructions to mechanics, provide one way to avoid this damage.

Bearing selection is seldom the problem of the maintenance force since most machinery comes already equipped. Where such a selection is necessary, however, it is well to remember, in addition to the obvious speed and load factors, other conditions under which the bearing will operate—whether the working area is unusually hot or cold; whether there are corrosive elements in the atmosphere, such as acid fumes, salt air, sand, grit, or grease. On these operating conditions and others will be determined the type of bearing to be used, the quality and the kind of seals or housings.

The cost of antifriction bearings varies from just a few cents for the cheapest unground and non-heat-treated type to several thousand dollars for the most expensive type of roll-neck bearings used in steel and

aluminum rolling mills. The object is not to install the most expensive bearing that can be purchased for its size and type, but to select the most economical assembly on the basis of the life expectancy and performance of the equipment into which it will go. In some instances—as in conveyors for example—this may turn out to be the cheapest bearing in price. In short, the reason that there are 18,000 different types and sizes of antifriction bearings is because each bearing installation is an engineered application of a precision product.

Replacement bearings should always be exact duplicates of the originals. This is most important. Despite the fact that many standard antifriction bearings of the same types and sizes are made by more than one manufacturer, the slight variations in manufacturing techniques and tolerances may be enough to make the parts of two different manufacturers fit improperly and lead to unsatisfactory performance.

New antifriction bearings go through a most rigid inspection, lubrication, and wrapping procedure before they leave the factory. In fact, these services account for more than half the total payroll of bearing manufacturers. All this careful workmanship is wasted if bearings are mistreated at the receiving end.

New bearings should be kept in their greaseproof paper and cartons until ready for installation. They should be stored in clean, dry rooms, and kept in bins according to shaft sizes so that they are always ready for quick selection and use. Many a bearing failure, incidentally, begins in the storage room as a result of (1) dirty bins, (2) broken boxes and containers, (3) lack of identification systems, and (4) removal of the protective compound. Never wash the grease or oil out of a new bearing. It is carefully selected and put there for bearing protection.

It is also important to touch new bearings only with clean hands and clean tools, and to handle as little as possible. Finger marks are hard to wash off, and perspiration starts corrosion.

LUBRICATION

PERHAPS the most vital factor in getting the maximum life and performance out of antifriction bearings is correct and adequate lubrication.

Lubrication protects the accurately ground and highly polished surfaces of a bearing from rusting and corrosion. It minimizes the friction resulting from the contact and slippage between moving parts; it reduces the metallic contact between moving elements and their raceways. Lubrication also helps in dissipating heat and in keeping the bearing sealed against outside abrasive or corrosive matter.

One of the major advantages of antifriction bearings lies in the fact that they require lubrication infrequently and thus make the maintenance problem relatively simple. This should not be taken to mean, however, that the lubrication job can be haphazard or that any lubricant is suitable. Quite the opposite. Because precision finishes are involved and turning speeds are usually high, the choice of the correct lubricant is vital.

There are five requirements in making this choice. The lubricant should have: (1) High chemical stability to prevent the formation of deposits or acid materials that can destroy bearing surfaces; (2) good water-separating characteristics, particularly when bearings are lubricated from a circulating system; (3) correct viscosity for operating speeds and temperatures; (4) good anti-wear or film-strength characteristics, especially where heavy or shock loads are involved; (5) adequate adhesive qualities for protection during idleness.

When to use grease. Under at least four different kinds of operating conditions, grease lubrication usually is recommended over free-flowing oils. Such greases, actually a mixture of oil and soap, are capable of forming a plastic film, and in this way cut down friction, wear, power consumption, and leakage. Types of service in which grease is preferable to oil include:

1. Mechanical designs that would result in excessive oil leakage (often brought about by high operating temperatures) and high oil consumption. In certain industries, such as textiles and paper, grease helps avoid staining of the finished product.

2. Mechanical designs that do not prevent the entrance of grit or water. Correctly selected grease acts as a seal and helps prevent wear.

3. Areas where the application of a lubricant is infrequent or hazardous owing to the number of bearings and their inaccessibility.

4. Low operating speed and heavy pressure conditions, which prevent the ready formation and continued maintenance of adequate separating films.

In selecting the proper grease for a specific application, consider these factors: Agitation, length of service, operating temperatures, water, moisture, excessive throw or leakage. To meet these varying conditions, there are three basic types of greases—lime base, soda base, and other soap bases. In making the selection, it is important to get the advice of either a bearing or a lubrication engineer, and, above all, to remember that there is no relationship whatever between lubricating a plain bearing and lubricating an antifriction bearing. The two are entirely different types of tools; except in the end use to which they are put, they bear no relationship to each other.

One instance of this fact is that antifriction bearings are made with tight seals. Forcing grease into them under high pressure with a grease gun, as with a plain bearing, may burst the seals. The bearing will then leak until the seals are repaired. This practice also is likely to produce an overloaded bearing. If the bearing space is completely filled with grease, the balls or rollers have to force their way through it, causing grease friction, overheating, and eventual failure. Proper packing, on the other hand, will often save enough in power costs to pay for the lubricants.

How much grease and how often to apply it is a problem that has always perplexed factory maintenance men. A properly lubricated ball or roller bear-

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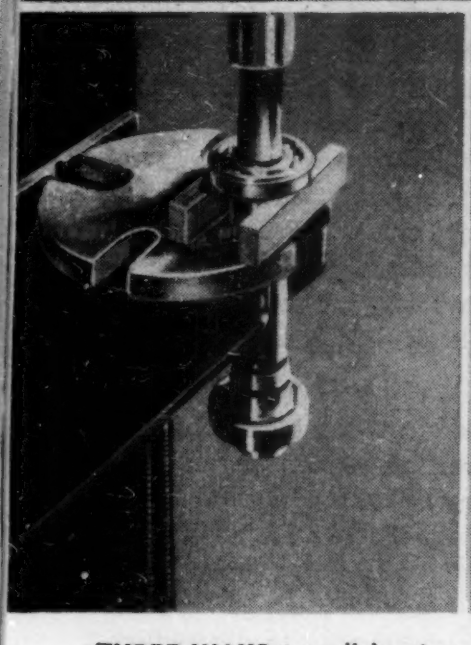
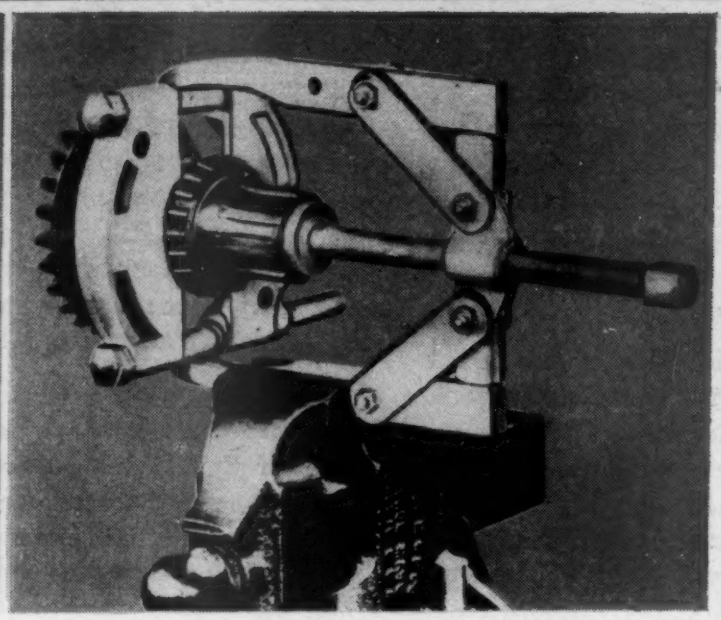
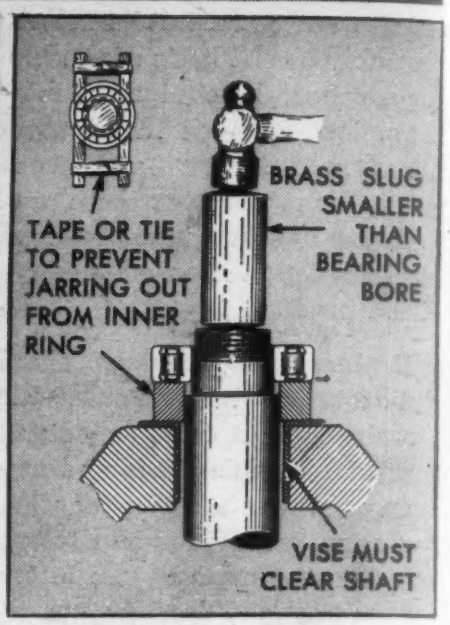
REMOVING BEARINGS

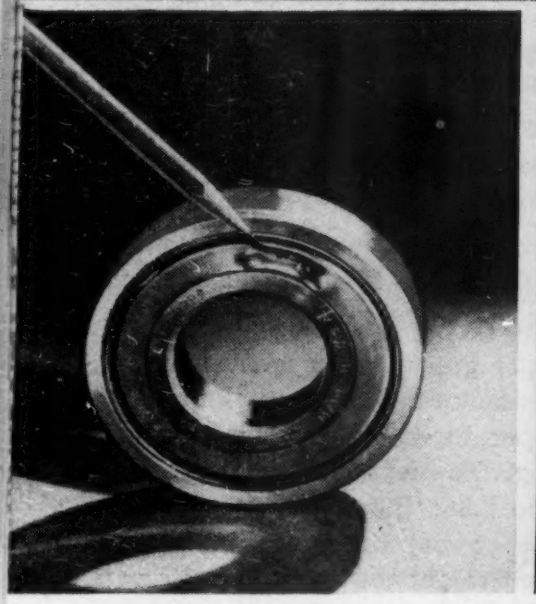


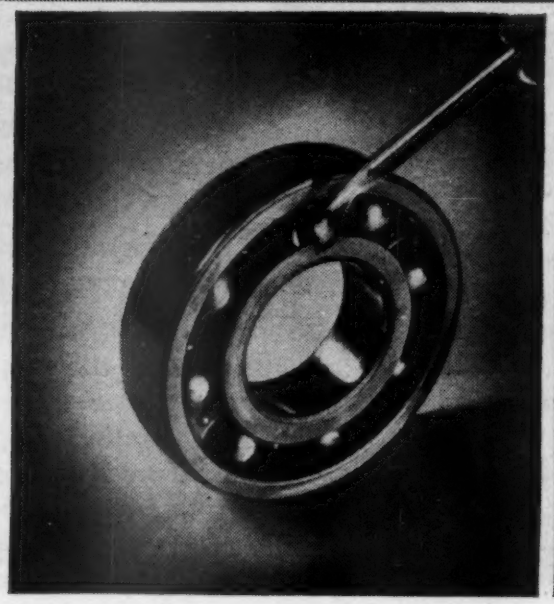


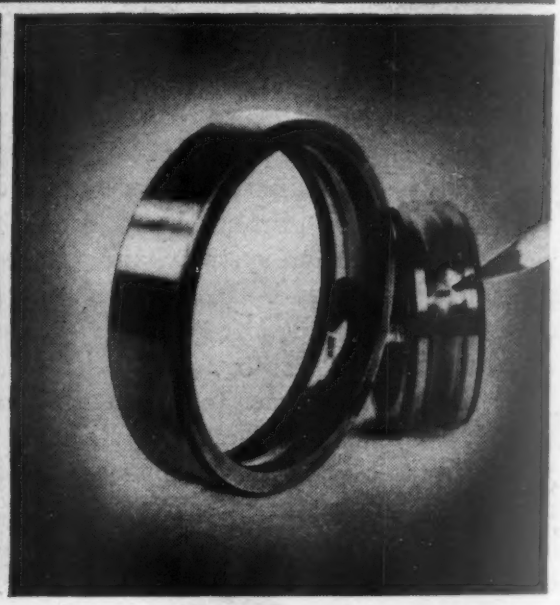


THREE WAYS to pull bearings: By arbor press (left)—use blocks of equal size and squared on all sides to assure even contact by both blocks. By bearing puller (center)—puller fits behind bearing or bearing ring; properly adjusted, it cannot slip over inner ring to damage parts. By improvising (right)—use soft metal drift smaller than bearing; inner ring must be supported

INSPECTING BEARINGS







BEARING DEFECTS include dented seals or shields (left), frequently caused by a drift that slipped in removal of bearing. Cracked or broken separator (center) often results from dirt or metal chips lodged betweent moving parts. Typical spalling on inner raceway of ball bearing (right). Flaking and spalling on balls, rollers, or raceways are primarily due to excessive overload

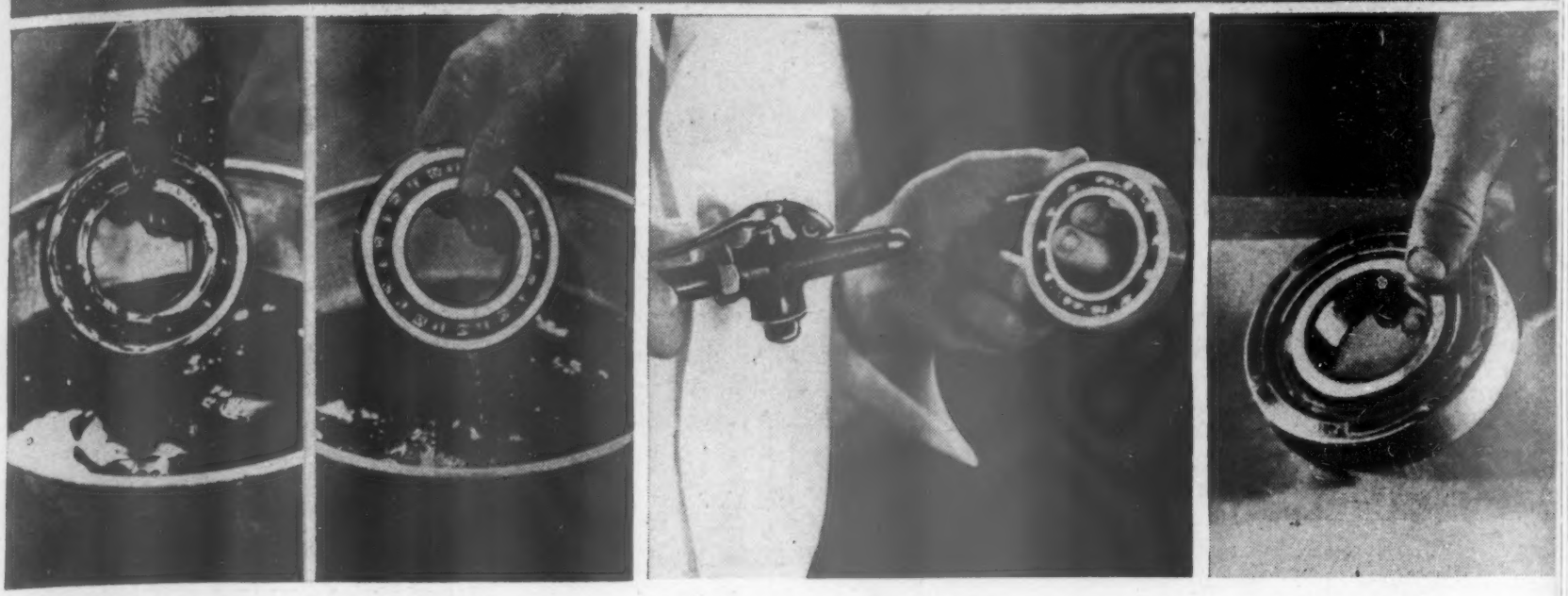
ing should be about one-third full in the bearing space. Then the sealing space, which is not in contact with the running balls or rollers, is as full as it should be. When lubricating an assembly, a good practice is to remove the drain plug, pump new grease in at the grease fittings until it comes out at the drain plug, and then run the bearing for about five minutes. After the bearing has had a chance to force out the excess grease, replace the drain plug, and there is every assurance that the seal has been left undamaged.

Lubrication requirements. With tight seals, many types of antifriction bearings need be lubricated only once in four or six months. Obviously there is no fixed rule for all applications. It is important to remember, however, that improper packing may require daily care.

The proper selection, care, and segregation of various antifriction bearing lubricants (more than one type of lubricant is almost always required) is a *must* in any efficiently run plant. To prevent misuse of lubricants, a good rule is to have only properly trained men handling them. Using only one type of grease in a gun and having that gun carefully marked will help prevent the grease designated for one type of bearing from being used on another requiring a different grease.

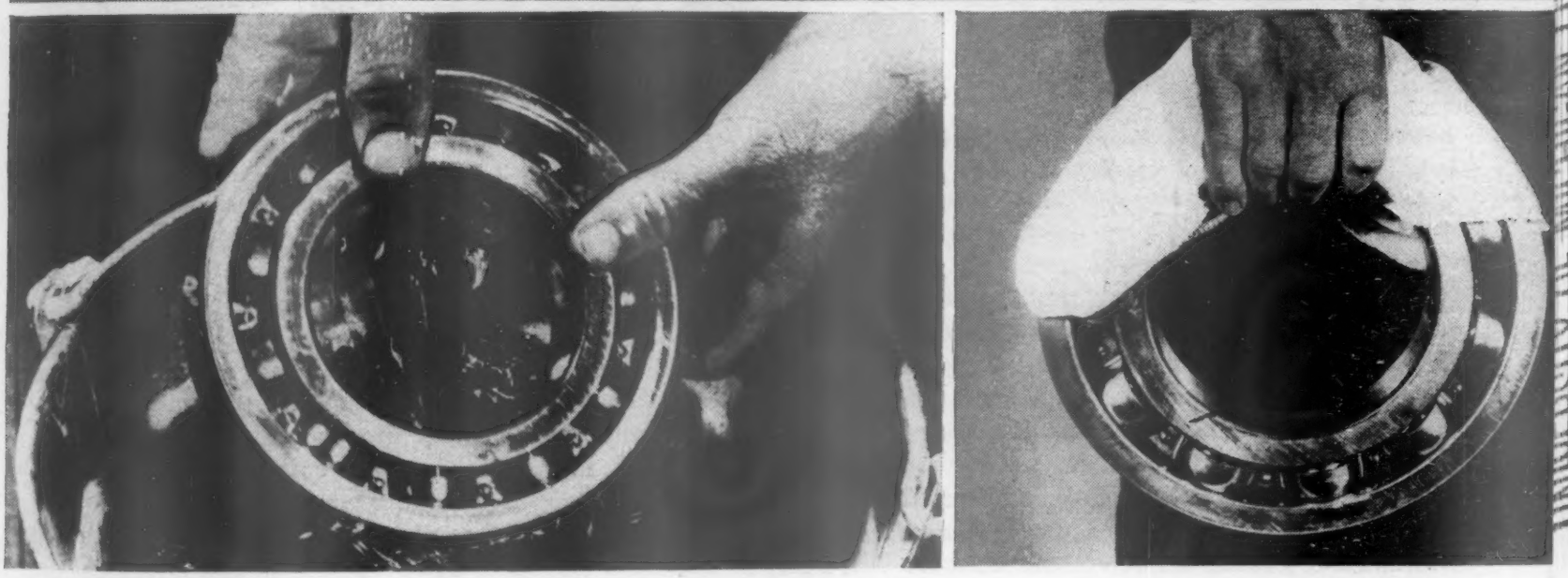
In the storage and handling of grease, cleanliness is absolutely essential. Dirt, dust, or any contamination shortens the life of a bearing and causes failures.

CLEANING BEARINGS



SOAK BEARING in dry cleaning solvent. Slosh it around at surface of solvent (left) and give it an occasional turn until clean. Rinse in clean solvent in clean container. Dry bearing with compressed air or with clean, lintless cloth (center). Bearings to be stored should be dipped in heated rust preventive or light grease (right). Rotate to cover rolling members and raceways

HANDLING BEARINGS



CAUTIOUS HANDLING prolongs bearing life. New bearings are cleaned and greased by manufacturer. Never wash grease off new bearings unless inspection reveals rust or dirt (left), in which case, bearings should be cleaned, inspected, and coated with new preservative. Clean hands and clean cloth (right) mean clean bearings and less chance of corrosion from perspiration

Clogged passages prevent grease from reaching the bearing. The precision finish of balls and rollers becomes pitted and causes bearing failure if dirt particles in the lubricant get in between the moving elements and the races.

Every new piece of mechanical equipment is supplied with a lubrication chart that specifies the kind of lubrication to be used, whether grease or oil. Follow these instructions carefully. Do not use grease where oil is specified or *vice versa*.

Frequency of inspection. As in lubrication, frequency of inspection depends entirely on individual operating conditions such as speeds, load, temperature. The bearing engineer or the manufacturer of the equipment involved will specify the service requirements, and records of these requirements should be kept. Electric motor bearings usually are checked once a month, wheel bearings for trucks three or four times a year, pulleys on presses once a month.

Gear cases on machine tools usually require inspection two or even three times a month, and small hoists once a month. Heavy and continuous-service crane bearings, on the other hand, may have to be looked at once a week, light service cranes only once in two months.

These inspection schedules are given only as a rough guide, because the check-up requirements even on the same equipment often will vary from factory to factory because of other external factors involved.

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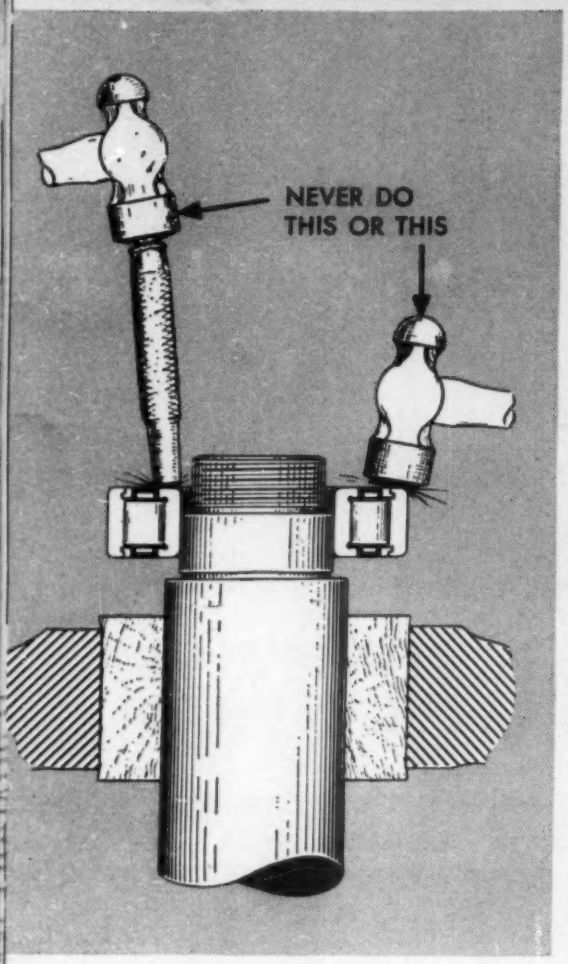
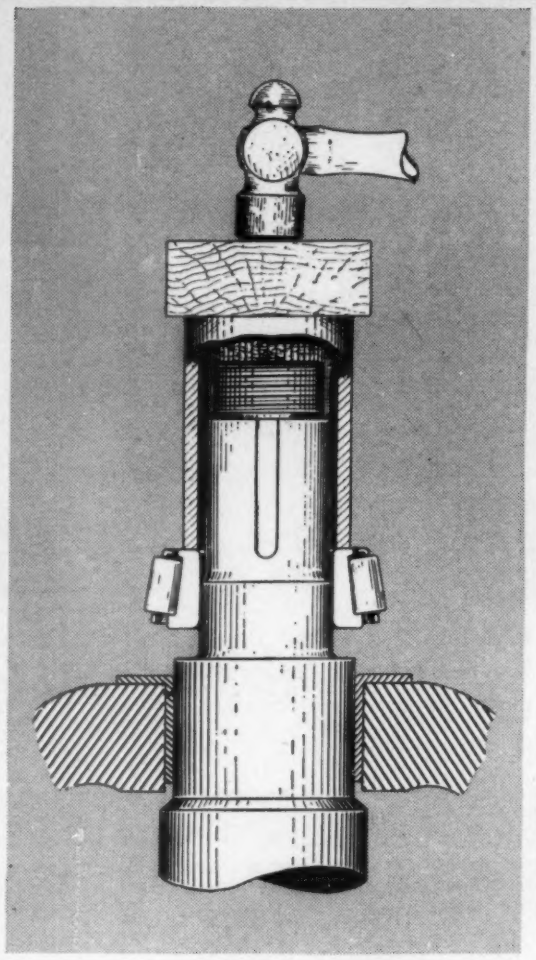
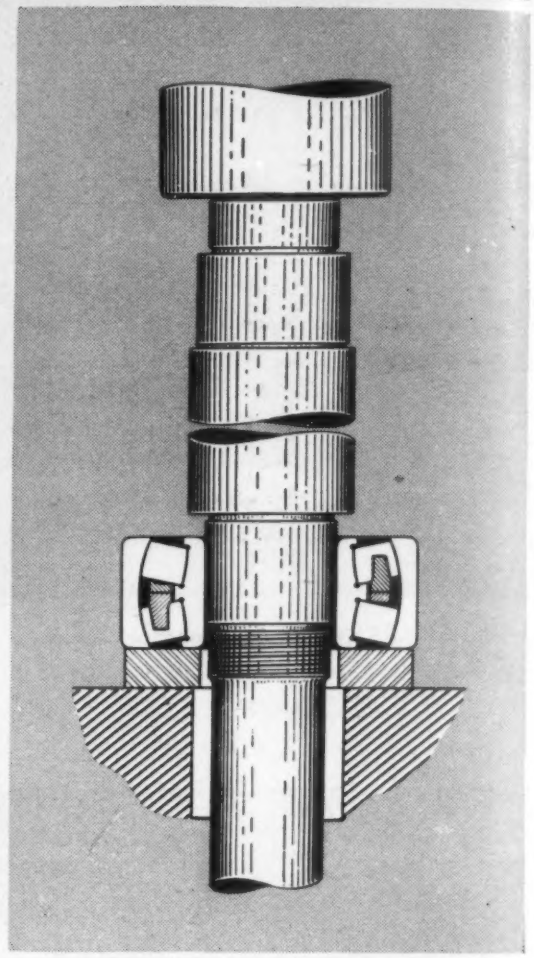
INSTALLING BEARINGS



NEVER hit directly with a hammer when installing or replacing a bearing; it is certain to cause serious damage



USE a clean tube to press a bearing onto a shaft when distance between end of shaft and bearing seat is fairly short



SUPPORT inner ring on blocks when using arbor press to force shaft into bearing. Be sure blocks don't scrape shaft or threads

Removal. Much has been said here about the importance of protecting the precision surfaces of antifriction bearing parts. Careful removal and thorough washing of ball and roller bearings at periodic intervals provides another way to protect these surfaces and insure the most efficient service. Before beginning the job of removing a bearing, however, take a few minutes to study the assembly and to determine the best way of getting it out without damage. The most efficient tool for doing this usually is an arbor press, although in field work and small shops one of the several varieties of bearing pullers will serve.

Remember that the bearing race that turns usually is put on with a tight fit. The stationary race, like the inner race of a front wheel bearing, usually is loose. Since the wheel hub revolves, the outer ring or cup is tight in the hub bore. When a piece of equipment is taken apart, the bearings stay with the member to which they are tightly fitted. If the bearings are made with separate parts—inner ring, outer ring, and ball or roller assembly—both rings may be a tight fit. To remove the bearing, press or pull wherever possible only on the ring that is tight. Press or pull straight and square to keep the ring from cocking, which might score the shaft or housing and could damage the bearing. Be sure never to press against bearing shields or separators.

When using an arbor press, be sure to keep the press table and the blocks clean and square. Provide some means to keep the shaft from falling to the floor. If the shaft and bearing are very large, and the shaft end cannot be squared up with the press ram, turn up two steel blocks to make a self-aligning fixture between ram and shaft. Protect the end of the shaft with a pad of lead, copper, or other soft metal. Use pullers properly, especially taking care not to damage shaft threads, keyways, or shoulders in the process.

Improvised tools. With normal care, bearings can be removed quite safely even with improvised methods if the right tools are not available. A vise will do instead of an arbor press, and a drift will take the place of the press ram. If the shaft is held in the vise, protect its surface with copper sheet or hardwood blocks. When using a tube, drive alternately on one side and then on the other to keep the bearing from cocking. If it becomes necessary to remove a bearing by pressure not directly applied to the tight-fitting ring, do not pound it off; use a puller or pry it off, exerting even pressure.

Sometimes a separable inner ring is installed against a shoulder of equal diameter so that there is no way to get hold of it. Leave the bearing ring on if it is usable. If not, cut it off with a torch. Burn it part way through in order not to harm the shaft. It may loosen enough to pull off. If not, crack it through the rest of the way with a hammer and cold chisel, using precautions to prevent injury by flying parts.

CLEANING

BEARINGS should be washed preferably in a small tank, using a wire basket. Kerosene or gasoline will do as cleaning solvents, but it is better to use a safety solvent intended for bearing cleaning only. Ethyl or anti-knock gasolines not only present a fire hazard, but also are poisonous when absorbed in cuts or inhaled. Let the bearing soak in the solvent for several hours, if necessary, to loosen grease and dirt; where scale or hardened dirt is involved, a short clean bristle brush can be used.

Bearings with a shield or seal on one side only should be washed, inspected, and handled in the same manner as bearings without shields or seals. Bearings with removable seals should be washed and inspected after removal of seals in the same manner as bearings without seals.

On the other hand, bearings with seals or shields on both sides should *not* be washed. Wipe them off to keep dirt from working inside. If they stick or feel too rough for further use, send them to shops where special shielded-bearing cleaning and lubricating equipment is available. Smooth-turning bearings of this type can be coated with protective lubricant, then wrapped and stored or returned to their original application.

After a thorough soaking in the cleaning fluid, washed bearings should be sloshed around near the top of the container and given a turn or two to work out all dirt. They should then be rinsed in a *clean container* filled with *clean solvent*. Use compressed air in drying, if desired, but above all do not spin by force of air. A few dry particles of dirt which may have been left in between the moving elements may then scratch the surfaces instead of being blown out.

Inspected bearings which are good enough to use again but cannot be reassembled in the equipment the same day should be dipped in a rust preventive after thorough drying, and stored overnight in a tightly covered pan.

If the bearings are to be stored for more than a few days, dip them in a protective lubricant or coat all surfaces with a light grease, rotating them to work the grease thoroughly around the rolling members and on the raceways. Wrap the bearings in greaseproof paper and place in a clean box or carton. If cartons are not obtainable, wrap them in a waterproof paper and mark the outside of the package to identify the bearings.

Inspection safeguards. After a used bearing is washed clean, it should be inspected to determine its serviceability. A little tarnish, stain, or corrosion on the outside surfaces of the rings is not detrimental to the operation of the bearing and need not be removed.

Unless better equipment is available, cleaned bearings that are not separable are inspected by holding the inner race so that its axis is vertical and turning the outer race slowly.

Until recleaned, bearings should not be rejected because they feel slightly rough or have a tendency to stick at certain points when rotated by hand. If even after recleaning, the bearings still feel rough and have a catch, inspect them more closely for the cause.

Familiar defects that make it necessary to discard a bearing include such things as:

1. Broken or cracked rings, often caused by improper fit or excessive force used in removal.
2. Dented shields or seals, frequently caused by a drift that slipped during removal of the bearing.
3. Cracked or broken separators, often a result of dirt or metal chips lodged between the moving parts.
4. Broken or cracked balls or rollers.
5. Flaked or spalled areas on balls, rollers, or raceways.
6. Brownish blue or blue-black markings on bearing parts, which indicate overheating.
7. Brinelled or indented raceways caused by impressing balls or rollers into the races.

Antifriction bearings should not show excessive wear unless dirt or other abrasive foreign matter gets into them where it can mix with the grease or oil and form a lapping compound that will quickly lap down the balls or rollers. Where excessive wear has taken place, the appearance of the balls, rollers, or raceways is nearly always clearly indicative of the condition. Bearings that are suspected of being too loose should be sent to organizations having proper equipment to determine their serviceability.

INSTALLATION

BEARING installation is just the reverse, in technique, to bearing removal. Use an arbor press, if available, and press the shaft into the bearing, supporting the inner ring on blocks. Make certain in doing so that the blocks do not scrape the shaft or threads. The bearing shafts and housing should be thoroughly cleaned. Dirt should also be removed from keyways, splines, and grooves. It is also important to clean and oil the bearing seats.

If the distance between the end of the shaft and the bearing seat is fairly short, hold the shaft in a vise and press the bearing onto the shaft with a clean tube. This can be done either with the arbor press or by tapping with a hammer evenly around the tube. If the end of the shaft is flush with the bearing, use a drift or bearing installer. These are made with flat ends to use with shafts that are flush with the bearing and with counterbores to use where the shaft projects beyond the end of the bearing for a short distance. Tap lightly at first to make sure the bearing or ring goes on square and does not scrape or burr the bearing seat. Be sure the bearing is tapped to a firm seat against the shaft shoulder.

On large bearings, the inner rings usually are shrunk on their shafts. This is a simple operation which consists of heating the bearing or inner ring in clean oil or a temperature-controlled oven to a temperature between 200 to 250 degrees Fahrenheit. This expands the inner ring sufficiently so that it should slip over the shaft to the bearing seat. Do not overheat the bearing or it will lose its hardness. If expanding the ring is not enough, cool the shaft in dry ice to make it shrink.

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MACHINING, BEFORE—TIME LOST REACHING INTO SKIDBOXES. AFTER—WHEELED RACKS QUICKLY SPOTTED IN BEST POSITION

ROLLING RACKS STORE AND MOVE WITH LEAST HANDLING

EDWARD J. WARWICK • PRODUCTION ENGINEER, WALKER-TURNER COMPANY, INC., PLAINFIELD, N. J.

OLD, unimproved materials handling methods can stall a new, efficient production scheduling and control system. They can reduce the output of modern machines to inefficient levels. And they can needlessly keep manufacturing costs in an otherwise efficient plant much higher than they should be.

Such were the recent experiences at Walker-Turner that led to a revamping of its materials handling methods. The results? The major complaints just outlined were remedied. Also, the way was opened to further refinements toward greater output and lowered handling costs.

The picture of the old conditions is probably a familiar one. Slow-moving raw materials, finished parts, and subassemblies were causing a definite bottleneck on the assembly line. Materials were being moved from start to finish in box trucks, toteboxes, and on skids. A stepped-up production program superimposed on the existing handling facilities was causing acute floor congestion and resultant overall inefficiency.

It was found that the cost of indirect labor for moving and expediting materials was disproportionately high. Skilled operators

were spending valuable time in non-productive practices growing out of the old handling methods. Scrap and rework caused by damage in handling were excessive.

The problem was solved primarily by substitution of several hundred special *wheeled* trucks for the old *static* materials handling equipment. These trucks, each occupying a floor space about 2x3 feet, contain five or more shallow, removable pans or trays which are tiered above one another on a vertical notched frame. Available storage area of each truck is therefore five or more times the floor space it occupies. Another important feature of this truck is the flexibility it provides by movement of work-in-process *on wheels* and by easy transfer of any one of its trays. Such flexibility was especially appreciated in this shop, which is set up primarily with functional manufacturing departments handling a multiplicity of parts and products.

A comparison of the conditions that used to exist in several typical departments with what is now accomplished by the new wheeled-truck equipment will reveal how a change in the method of handling transformed congestion of space and movement into free and easy flow.

Small parts manufacturing department. Here several operations are involved in the machining of the steel shafts, spindles, racks, and pinions that go into the company's product. Work flows from automatics to turret lathes, and then to a checking station. There follow moves to grinding, milling, hobbing, drilling, and burring operations, and then a final inspection.

Formerly, when all work was handled in totepans and box trucks, many parts were dropped or thrown by operators from bench height into these containers at skid level. Polished surfaces were marred, threads were burred, and rework accumulated progressively down the line.

Because of floor congestion the operators, working on an incentive based on standard time, lost time in moving pieces from and returning them to skids located too far away from their machines. Time was lost also in hunting for lift trucks to maneuver skids of work in place because operators did not want to wait for truckers to do so. Consequently the company lost money by paying operators to do this work. Because of a laxity of control over *in* and *out* time for material moves, too often a portion of production time was charged to material moves, leading to higher bonuses for shortened production time.

Against this picture of congestion, loss of production efficiency, and inability to follow production schedules, stand these results of changing to wheeled-truck movement.

1. Non-productive time of productive operators making moves or waiting for a trucker has been eliminated. Truck moves can be controlled by foremen, who now countersign all move tickets. Once delivered to a machine, the wheeled trucks can be easily and quickly positioned by the operator.

2. Tiered trays make all parts equally accessible, hence there is no reason to favor easier work. By leaving one tray empty between moves, operators can return finished work to the same truck, since they work from one tray level to another. The time needed for handling parts from the truck to the machine has been included in the incentive. A 5 per cent "general delay" allowance has been built into the time standard to cover procurement and disbursement of work in each operator's working area. This is dependent on number of pieces and time cycle of the operation.

3. Damage to highly finished parts has been minimized because operators can easily reach trays and stack parts in orderly fashion. Both rework and scrap have been drastically reduced.

4. Checking, identifying, and counting pieces of work-in-process by expediters or timekeepers is now simplified by visual observation. Unscrambling and hunting have been eliminated.

5. Floor space required for work-in-process not only has been curtailed, but also the capacity of in-process inventory has been more than doubled. Inspection and working areas are relieved of former congestion. Wheeled trucks follow each other successively from the first operation to the final assembly. This allows work fluidity and retention of production schedules. Also, it permits quick shifts in line-up to meet sudden changes in schedules without penalizing efficiency.

Drilling department. The particular problems here, in addition to many of those already pointed out for the preceding department, were an excessive damage to finished surfaces and evidence that operators were found to be doing more trucking than the truckers.

Piling the machined cast-iron drill heads on skids led to a high scrap rate, and considerable breakage when stored in deep boxes. By adopting specially designed holders in which to suspend drill heads, machined surfaces are now isolated from one another, and rework or scrap has been eliminated. Also, there are very few complaints about paint chipped from outside surfaces, which later required touching up.

Introduction of wheeled trucks in movement of work shows a reduction of almost two-thirds in total departmental trucking cost, most of which was formerly charged to productive workers. Before the change a typical 6-week period showed a total trucking cost of $531.80, of which $437.88 was for productive operators alone In an equal period afterward, for slightly higher production, the total cost was only about $190.

Assembly department. Parts were formerly issued in miscellany from storage to fixed bin shelving at assembly tables. Now they are issued more easily in "measured" lots with all components placed on a single truck. Compartmentalized trays of various sizes have been provided to hold different sizes and quantities. Extra fluidity of assembly operations is achieved by the ability to exchange trucks, or even trays, or re-position them to meet any layout changes.

Similar achievements could be quoted from other departments down the line. They all sum up to substantial savings in time and material because of less and easier handling of work-in-process with the wheeled equipment.

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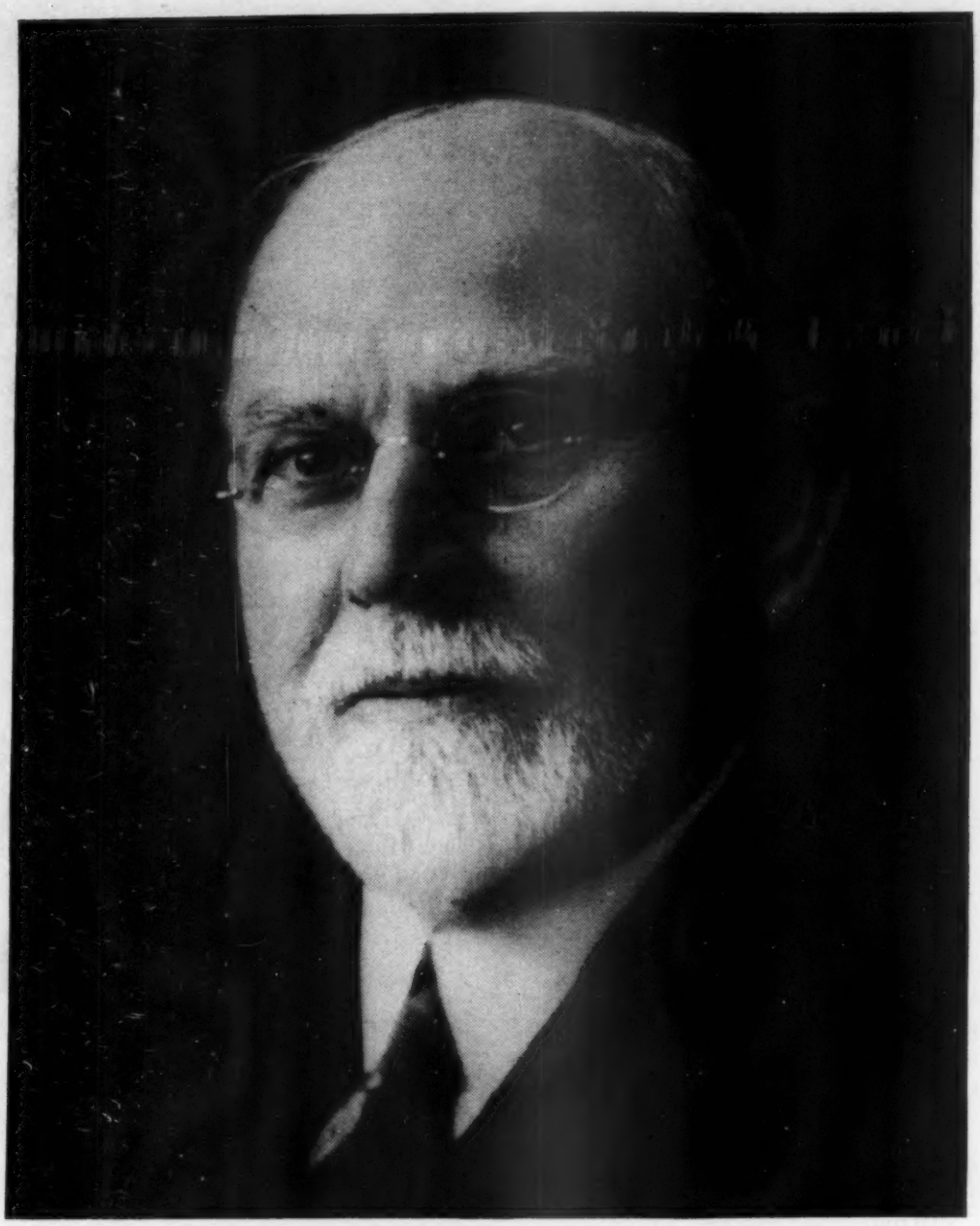

JAMES H. McGRAW

FOUNDER OF McGRAW-HILL DIES

JAMES H. McGRAW, dean of industrial publishers, died February 21 in San Francisco.

Mr. McGraw began his publishing career in 1884 as a subscription salesman. He progressed steadily through one of the most colorful careers in publishing history, until he had laid the foundation for the largest industrial publishing organization in the world, the McGraw-Hill Publishing Company, publishers of 26 national and 8 international magazines, and, through its subsidiary, the McGraw-Hill Book Company, largest publishing house specializing in technical and industrial books.

On Dec. 27, 1935, he resigned as chairman, when his responsibilities were taken over by his son, James H. McGraw, Jr., who assumed the presidency and chairmanship.

Set Editorial Standards

It has been said by his associates that Mr. McGraw always had a "remarkably high standard of dissatisfaction." He pressed continually for improvement in editorial competence and authority, in advertising ethics and proficiency. He insisted upon editorial leadership based on constant field contact and active participation by editors in the activities of their industries.

Born Dec. 17, 1860, in Panama, N. Y., Mr. McGraw attended the State Normal School at Fredonia, and at the same time taught at a district school. Upon graduation from normal school, as valedictorian, in 1884, he was appointed principal of the district school.

When Chautauqua County friends started "The American Journal of Railway Appliances" and purchased a little paper called "Steam," the temptation was too much. He made the decision that was to change the entire course of his life. He left his country schoolhouse to make his fortune in New York by selling subscriptions. But at the height of his career he said, "I believe I should have loved teaching better than publishing."

In 1929, Mr. McGraw received the degree of Doctor of Commercial Science from New York University, conferred on him as "an educator transformed into publisher, who has never ceased to be an educator."

The Bok gold medal, presented annually as the Harvard Advertising Award, "for distinguished personal service rendered American commerce and industry through raising the standards of advertising," went to Mr. McGraw in 1927.

In 1924, the publisher established the James H. McGraw Award "to encourage constructive thinking for the advancement of electrical industry," the endowed award of four medals and a purse, given in recognition of the most important personal contributions to electrical progress in the manufacturing, wholesaling, and contracting branches, and for cooperation in promoting the general welfare of the industry.

Factory Management and Maintenance is the direct result of expansion activities of Mr. McGraw. In 1927 he purchased *Factory* from A. W. Shaw Company and *Industrial Management* from Engineering Magazine Company. The two were combined to form *Factory and Industrial Management*, the predecessor of the present publication.

PRESENTING MANAGEMENT'S CASE TO THE ARBITRATOR

Here's how management can come to the arbitration table with a better case. The author's suggestions are drawn from wide experience as arbitrator for the U. S. Conciliation Service, the New York State Board of Mediation, and the American Arbitration Association

JULES J. JUSTIN • MEMBER OF LAW FIRM OF KAISER, HOLZMAN & JUSTIN, NEW YORK

MANAGEMENT is still grappling with the tools of arbitration. From the arbitrator's seat at the table, it is clear that management has not yet fully applied its skills to this important process. Too often its representatives have only partially explored the possibilities afforded. The conclusions presented in this article are based on my experiences during many years of arbitration.

Although management negotiators include arbitration in their collective bargaining contracts, they frequently do not correlate it with the employer-employee relationship. They allow it to become a "one-way street." In too many cases they do not recognize its impact upon collective bargaining. And usually they handicap themselves by coming before the arbitrator with a "defendant" psychology.

With arbitration coming into increasingly wider use today, it is important that management know—and use—its possibilities. An estimated 75 per cent of collective bargaining contracts today provide arbitration as the final and binding method of settling disputes arising under contract terms. Many contracts allow submission of all grievances to an arbitrator. Others, with increasing frequency, provide for arbitrating wage adjustments upon contract re-opening. Sometimes the new terms of renewal agreements are left to the arbitrator.

Management's stake in the arbitration process equals that of unions. In great part, management has met its responsibility in seeing that voluntary arbitration works. There are, however, many points that have been overlooked.

As the arbitrator sees them, here are some of management's chief shortcomings:

1. Poor craftsmanship in drafting contract clauses.

2. Neglecting to use its foremen to best advantage.

3. Underestimating the value of a "management clause."

DRAFTING CONTRACT CLAUSES

Going before the arbitrator is not the first, but the last, step in arbitration. The process really starts in negotiating the contract.

The management negotiator's prime responsibility is to see that the provisions written into the contract fully cover the subject and unequivocally express the parties' intentions. The effect of one provision on another, their interdependence and interrelation, must be reckoned with. The negotiator must be alert to the impact of the arbitration clause upon each provision of the contract. He must check the finished product, asking himself: *What will this clause, written as it is, mean to a "third party"*—an arbitrator?

Example 1. This is particularly important on new provisions, the clauses covering new features of the contract. The "holiday benefit" provision written into many recent agreements presents a timely example of faulty draftsmanship by both management and unions in many instances. Judging from the numerous cases already presented to arbitrators, the provision granting holidays with pay was given little care in writing the contract.

Typical clauses, widely used in major industries, merely agree that employees should have "full salary" or "pay" at regular rates for six specified holidays, "as if they had worked thereon." In many cases, Washington's Birthday was one of the enumerated holidays. Last year it fell on Saturday, which in most instances was outside of the regular or contract work week.

The question posed to the arbitrator was whether the holiday, Washington's Birthday, should be paid for, even though it fell outside the work week.

Both sides presented good arguments. Both, in almost all cases, relied upon other related clauses in their contracts to sustain their positions. Obviously, arbitrators' findings varied, depending on the circumstances. In these cases, it was not a matter of the arbitrator's "substituting" his judgment for that of one of the parties. His function was limited to "finding" what the parties intended by the particular clause.

And—*he had little or no help from the clause as it was written.* In these cases, the disputes stemmed directly from poor craftsmanship in writing the contract.

Example 2. The importance of exploring the interdependence of clauses, when writing a contract, is shown in a recent arbitration case involving a layoff.

The contract's seniority clause provided that employees were to be laid off in order of seniority, department-wide, provided the senior employee was able to do the avail-

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able work. A promotion clause in another section of the contract gave the company the right to try out for a short period the ability of the promoted employee to do the new job.

Before the arbitrator, the union claimed that, although an employee who had been laid off had not done an operation for which a junior employee was retained, he would have been able to do it if given a short trial period. Under the contract, he should have had the opportunity, the union declared.

Adding one word "then" to the clause when it was written, making it read "provided the senior employee is then (at the time of the layoff) able to do the available work" would have clearly stated the management's intention and avoided the necessity for arbitration.

Example 3. Harassing arbitrators many times is the question of whether or not an issue is "arbitrable." Does the arbitrator have the authority, under the contract, to determine the dispute?

For example—and a type of issue frequently brought up today—one contract termination clause provided that the "question of wages" may be re-opened on the anniversary date—and determined by the arbitrator if the parties could not agree.

When the time rolled around, the union sought not only a general, across-the-board wage increase, but also an extension of holiday and vacation provisions, sick leave benefits, change in overtime rates, and call-in pay. The employer contended that the "question of wages" meant only increases, if any, in wage rates.

Example 4. A similar clause in another case provided that the union might ask for "a rate review with the object of adjusting rates." The union claimed, under the phrasing, in addition to a general wage increase, a change in differentials in existing rates, and elimination of interplant inequities. The company contended here that the phrase meant only a general wage increase. Oddly enough, with this language, it is conceivable that the position of the parties might have been directly reversed.

But—if "wage rates only" is meant, *why not say it?* Why leave the arbitrator groping in the dark to find the intent of the parties? And, while the negotiators are working over the wage clause, why not clearly set forth their intention as to the effective or retroactive date for wage increases? Why leave it to the arbitrator to hunt for one after the question has been opened and negotiated a couple of months?

There is no short-cut to clear and explicit clauses. Arbitration is no substitute for them. Ambiguity cannot be defended by hindsight. Clarity is the essence of negotiating.

MAKING BETTER USE OF FOREMEN

How foremen stand in management's eyes—and the opportunities management misses in not making better use of lower-level supervisors—is best seen from the arbitrator's vantage point.

In the first place, the foreman often is not even present at the hearings.

When he is, he is usually, in spirit or practice, *not* on management's side. He is regarded as a witness, called to verify or explain points of evidence, and not as one of management's advocates. He is not the "boss" that he is on the floor. He is eclipsed, even ignored. He is really the "forgotten man."

The union, on the other hand, promotes fully the position, responsibility, function, and prestige of its shop stewards and committeemen.

The foreman's frustration, it is evident in a hearing, goes back even further than the grievance and dispute stage. It originates from his absence and seeming oblivion during the contract negotiations. Often he has to find out how the grievance procedure is set up from the shop steward. He merely carries out orders coming down from above, without knowing how they were arrived at or where they originated.

Stewards and committeemen, however, get experience which is constant training and education in collective bargaining, grievance adjustment, and arbitration "know how."

Foremen should have training and experience matching that of the stewards with whom they deal. They should originate disciplinary action—and they should see it through at its ultimate conclusion, the arbitration table. If they did, both sides would gain and the burdens on arbitrators would be lighter.

Example 1. I have known cases in which one statement by a foreman established the facts needed to make the correct determination. In one instance, a union claimed a number of employees were improperly classified. One hearing, at which the foremen were not present, availed nothing. At a second, where foremen were brought in on the arbitrator's insistence, the foremen clarified the claimants' qualifications. Their statements, such as, "Now, John, you know you didn't do any work to such close tolerances," laid the basis of facts for a correct decision.

Example 2. In another case, five minutes of concise exposition by a foreman convinced even union representatives that there had been no violation of contract. The issue was one involving seniority, and hours of testimony, plus misstatements of facts by both union and management, could have been saved by bringing the foreman in sooner.

A foreman should be allowed to assume his full responsibility by being obliged to support and defend, through all the steps of the grievance procedure, including arbitration, his original action or management's action that affects his department. He should not sit on the sidelines. He must be trained to regard the grievance procedure as a means to uncover and eliminate conditions causing discontent in his department. By engendering confidence in his ability and fair-mindedness, he will obtain his employees' cooperation in plant efficiency, and increased production. He can succeed only if he is given full opportunity to play his role. The arbitration hearing is part of it.

It is possible that management may "lose" a borderline case as the

cost of training a foreman in arbitration techniques. More likely, the foreman's desire for a just resolution of the dispute under which the parties can "live," his knowledge of the facts, and his straightforward presentation will convince the arbitrator more quickly than top-line executives could. In any case, making the foreman a real advocate will build him as a person and will enhance his prestige as a supervisor enough to make it more than worth while for management.

INSERTING A RIGHTS CLAUSE

For a long time now, management has been divided on the worth of a "management's rights" clause in the bargaining agreement.

A management clause usually covers:

"The management of the company and the direction of the working force, including the right to plan, direct, and control plant operations; to maintain the discipline and efficiency of employees, and to require employees to observe company rules and regulations; to hire, lay off, or relieve employees from duties; to suspend, demote, and discipline and discharge employees for cause, are to be the sole right and function of the employer."

A number of additional items may be included:

"The products to be manufactured, the location of plants, the schedules of production, the methods, processes, and means of manufacturing, are vested solely in the employer."

The clause also may contain the statement:

"The parties agree that the foregoing enumeration of management's rights shall not be deemed to exclude other functions not specifically set forth, the employer therefore retaining all rights not otherwise specifically covered by this agreement."

And it may conclude:

"The exercise of the foregoing rights shall not alter any of the specific provisions of this agreement, nor shall they be used to discriminate against any member of the union."

Management men who oppose such a clause argue that it is unnecessary to secure union recognition of rights which have always been vested by law and by custom in management. They regard the collective bargaining agreement as a one-way street which demarcates the specific areas of plant operation and employee relations in which the union now has a voice. Remaining areas are deemed vested in management. Since all of them cannot be enumerated in the contract, their omission may by implication be construed as a waiver.

The other school of thought believes that if both parties have rights in the contract, both management's rights and the union's should be set forth and enforced. If both have responsibilities, they should be frankly recognized. Then, with teamwork, the parties can stabilize plant operation and better employer-employee relations. Members of this school of thought don't fear that a general statement of management's rights will give ideas to the union or encourage demands for more restrictive provisions in the future.

From the arbitrator's chair, it seems that the pragmatists in the latter school make out a stronger case. Certainly a tangible management clause has a real and practical impact upon arbitration proceedings.

An arbitrator cannot exceed the limits of authority agreed upon by the parties and set forth in the contract. When an issue revolves around interpretation or application of an ambiguous clause in the contract, the arbitrator must determine what the parties intended by the language used.

Often no specific clause covers an issue in dispute. Then the parties rely on other provisions to support their positions by implication and assumption. Here a management clause carries great weight. It is far more compelling than reliance upon common law rights or the theory of bargaining.

The following instances, taken from actual cases, illustrate the type of issue that may not be covered by a specific clause. In each of them, arbitrator's decisions were based on the management clause, the controlling provision in each of the contracts:

Example 1. To fill a newly created position a company hired a new employee—whereupon the union charged violation of the promotion provision of the contract. The company contended that the contract provision referred only to transfers, promotions, or demotions within a department. It was not intended to cover a position such as the one under dispute where the new employee had supervisory functions over several departments. The management clause supported the company's position. On that basis, the arbitrator ruled that there had been no violation.

Example 2. In another case, the company relied on the management clause to support its right to select employees for lead positions, without regard to seniority.

The management clause was relied on in other cases involving the right to lay off employees, the scheduling of work on Saturday when it meant requiring employees to work overtime, making changes in jobs required by changes in processes, and downgrading employees in lieu of *bona fide* layoffs.

In its broader aspects, the management clause makes the collective bargaining agreement a mutual arrangement of relations. The functions and responsibilities of the employer, as well as those of the union, are explicitly set forth.

A management clause helps prevent a contract from becoming a one-way street. It also limits shifting responsibility to the arbitrator.

Management can profit by fully exploring these and other phases of the arbitration process. And both sides will benefit from smoother handling of grievances and disputes when they finally reach the arbitrator. The machinery is available and it is being more widely used every day. Both parties share responsibility for making it work well.

After all, the arbitrator's job begins only where the parties have left off.

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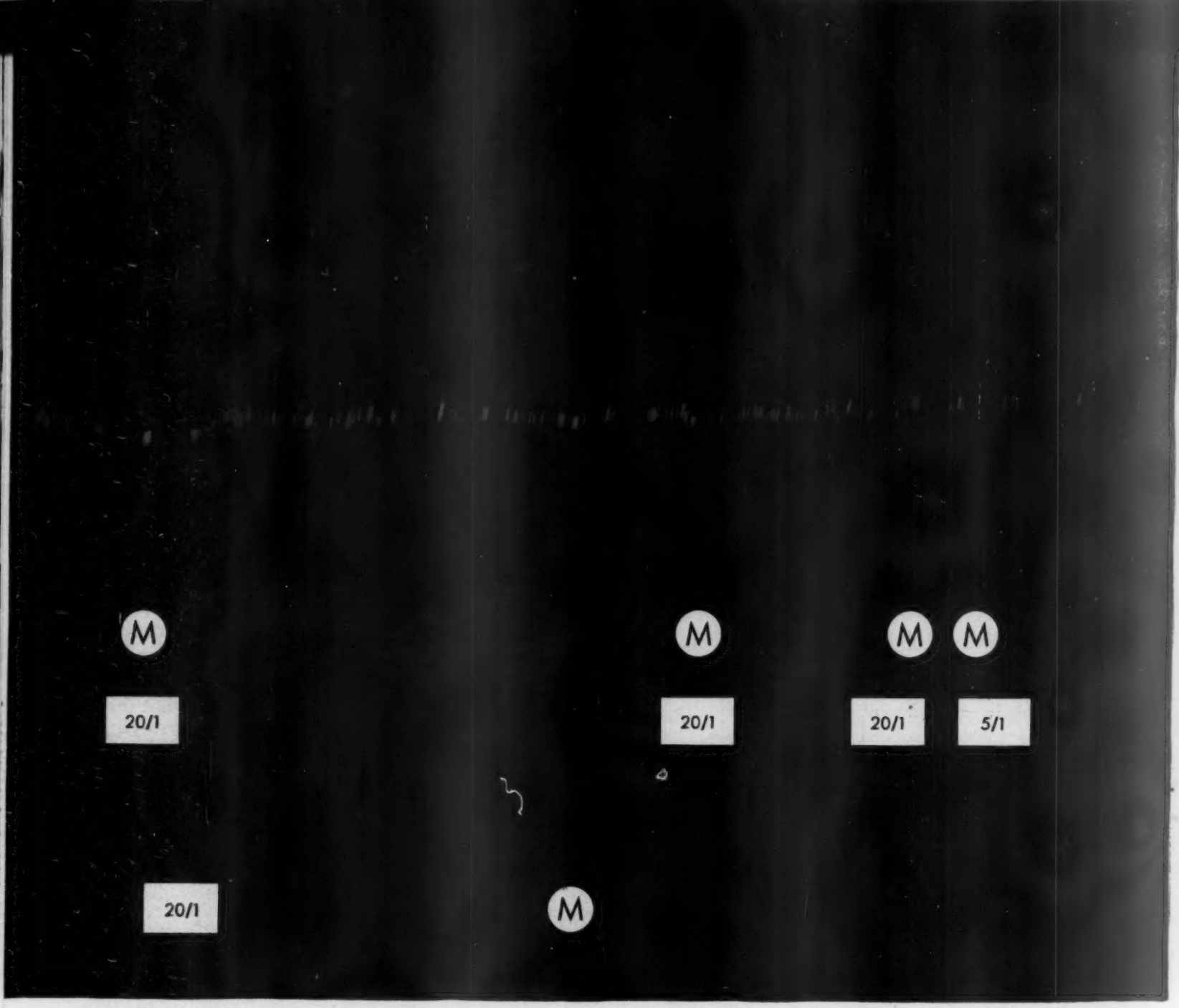


1. SCHEMATIC ARRANGEMENT of cookie and biscuit machines that take raw dough and deliver the packaged product a few hundred feet away. Each section has its individual drive, capable of maintaining almost any ratio of speeds with respect to one

CLOSED-CYCLE MOTOR CONTROL: WHERE IT IS USED

Second of three articles. Last month, what closed-cycle motor control is. The third will appear in an early issue

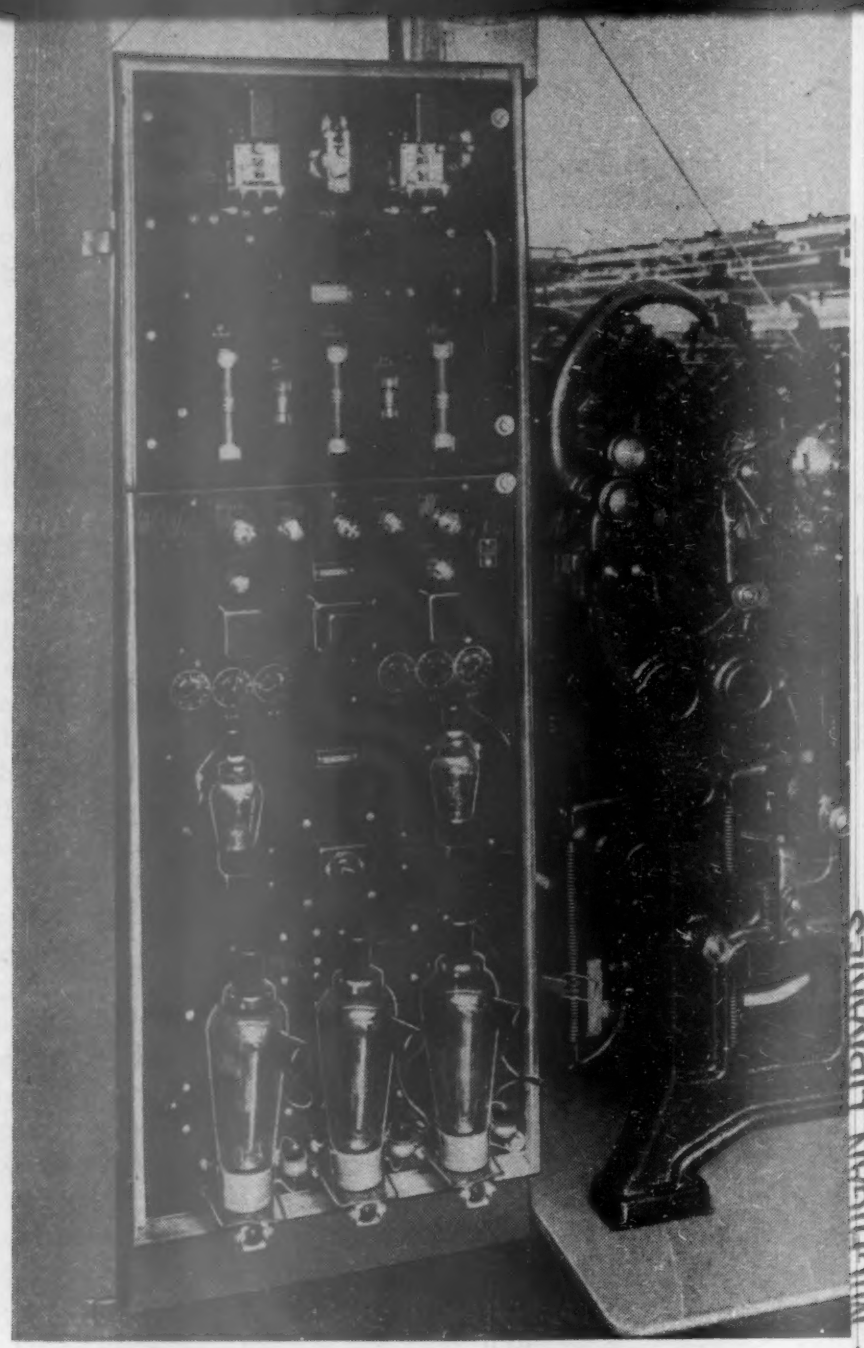
B. COOPER • CONTROL ENGINEERING DIVISION, GENERAL ELECTRIC COMPANY SCHENECTADY

TYPICAL applications of closed-cycle motor control, resulting in better machine performance and higher quality output, include the following:

1. Paper Machines

In most modern paper machines the different sections—the wire screen, presses, dryers, calender, and reel—are driven by individual motors that must be made to run almost in synchronism in order to maintain proper draw and tension without breaking the paper. Here electronic control uses a tachometer as the primary feedback element to measure paper machine speed and provide the accurate speed control necessary for a most exacting application. With the larger horsepower drives, the electronic control element provides excitation for the fields of an exciter of special design, which in turn controls the speed of the paper machine motors or the main power elements. Closed-cycle motor control, using electronic amplifiers, is needed to provide the quick, accurate control of speed necessary to keep the proper draw and tension between sections, and to meet an ever-increasing demand for production rates.

another, within the normal range of speed control. Each drive is equipped with electronic variable-speed control

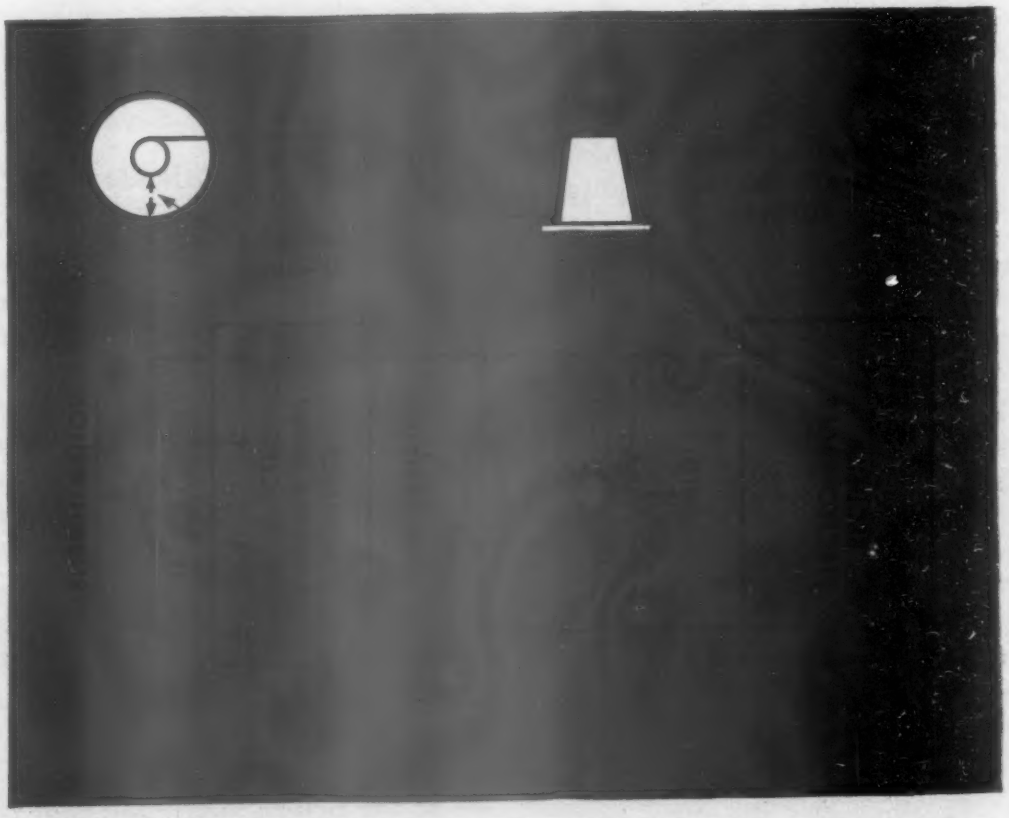


2. FULL-FASHIONED HOSIERY KNITTING MACHINE has electronic variable-speed control to regulate speed of 5-hp motor

2. Printing Presses

Modern newspaper printing presses are utilizing closed-cycle motor control to provide wide range adjustment of speed, plus accurate speed control. Many of the large press drives now under construction will employ ignitrons or water-cooled electronic power tubes to supply the power directly to the press drive motors. Here, closed-cycle control provides the closely controlled printing speeds, which may easily be adjusted to meet the different requirements of black and white or color printing.

For this application, the primary feedback signal for controlling speed is taken from the armature voltage with IR drop compensation added to take care of load variations. Accurate control of low threading speeds eliminates the need for the auxiliary motors and special gear-



3. GENERAL ARRANGEMENT of typical wire rewinding drive with electronic variable-speed control, which increased winding speed from 600 to 2000 feet per minute

ing previously required on conventional drives.

Also with these larger horsepowers, the higher efficiency of the electronic rectifiers is another important factor in favor of the all-electronic control for this drive.

3. Biscuit Machines

Some modern bakeries are using cookie and biscuit machines that take raw dough and deliver packaged cookies a few hundred feet away, on a conveyor line. Figure 1 shows a typical application.

For molded cookies, the raw dough usually is fed into a rotary molder that produces cookies of the required design. Where the rotary molder produces a continuously engraved roll of dough, bar cutters slice the dough into the desired lengths. When fig bars or wire-cut goods are made, section 2 is used. For fig bars, the wire cutters of section 2 are not used, since the bars cannot be cut until after they come out of the oven. However, for other cookies, the dough is extruded through various shaped dies and sliced to the proper thickness by the wire-cutting fingers.

The cookie is then moved on a conveyor through the oven, thence to the cooler conveyor, stacker, and finally the packing table.

Speed of the stacker and packing conveyors is determined by the size of the cookies and the number per package.

Each of these sections has its individual drive, capable of maintaining almost any ratio of speeds with respect to one another, within the normal ranges of speed control. They are coupled together through electronic controls, so that any adjustment of the master unit will automatically re-adjust the speed of the other sections. The maximum rate at which the machine can operate usually is determined by the ability of the oven to bake the dough properly. For this reason, the oven usually is considered to be the master unit and other conveyor and cutter speeds are held relative to the oven conveyor speed.

Each individual drive is a closed-cycle control, using armature voltage feedback with IR drop compensation. Accurate control of the speed ratios between sections is maintained only through the inherent ability of each individual drive to maintain its own absolute speed. Use of direct-connected tachometers as a feedback means to measure relative speeds would provide a superior system, but economics and the fine performance of armature voltage feedback systems favor the system described.

4. Knitting Machines

In applications discussed thus far, accurate speed control of a system of motors is a major requirement. There are many cases, however, where individual motor controls may be applied in an equally effective manner. In the full-fashioned hosiery knitting machine, Figure 2, accurate control of speed is required over approximately a 10-to-1 range, with high acceleration and deceleration rates.

Armature voltage feedback with IR drop compensation provides a closed cycle with enough accuracy and response to satisfy all conditions.

During the knitting of the stocking, there are a maximum of five pre-set speeds, any one of which may be selected by a programming chain. These different speeds are necessary to obtain satisfactory knitting performance during the various "narrowing" "welt-turning" and other machine cycles. Closed-cycle motor control was a natural for providing good speed regulation at any one of several pre-set speeds, plus allowing simple and accurate means for selecting these speeds.

5. Rubber Calenders

In the manufacture of automobile tires, closed-cycle electronic motor control plays an important part, not only in producing the tire itself, but also in providing the rubberized fabric of which the tire is made. Electronically controlled d.c. motors determine the speeds of various sections of large rubber calender trains, which take a high-grade fabric, impregnate it with rubber, and produce the rubberized cord and fabric that are the basic materials for tires, or other rubber products.

6. Tire-Building Machines

In building tires, an electronically controlled motor drive or a closed-cycle motor control provides a number of pre-set speeds, as well as different torque limits during parts of the cycle, to meet the requirements. On the tire-building machine, individual plies of calendered fabric, cut to length, are wrapped around a motor-driven drum in successive layers. Then the tread stock and the gum stock for the sidewalls are also added.

Each ply usually is placed on the drum at a relatively low speed, after which the drum is rotated at a high speed while the operator stitches the plies together by means of a pressurized roll. While the fabric is being put on the drum at low speed, low torque limits also are automatically maintained by the electronic control to prevent injury to the operator, if he becomes caught in the machine. During the operation under low-torque conditions, the primary feedback element is a current transformer in the power lines.

This feedback functions through the current limit tube in the control element, limiting the current output of the power rectifier, and therefore the torque of the motor. When the production cycle requires a different torque limit or speed control instead of torque control, an interlock is operated to switch the feedback element to a different setting or a different function, as may be required.

Use of the electronic control eliminates many of the operator's motions, for with previous conventional machines all low-speed operations were obtained by intermittent jogging of an a.c. motor. Continuous control and definite selections of operating speeds and torques not only reduce maintenance on the control parts and motor, but also provide greater safety and require less skill.

7. Reeling Paper, Wire, Etc.

One of the most promising applications for closed-cycle motor control is in reeling and re-reeling paper, wire, steel strip, and fabrics. Reeling drives commonly fall into two classes. First are those drives that take the finished product from a machine and wind it in rolls. With this drive, tension is maintained during the build-up of the reel, by directly measuring the tension and operating the control accordingly.

Or constant tension is approximated by supplying a constant-horsepower input to the reel drive motor. When friction and other losses in the reel mechanism are relatively low, most of the input is utilized in maintaining tension. Hence, holding constant-horsepower input approximates constant tension.

In a constant-horsepower input system, both armature voltage and armature current feedback elements are utilized. By using armature voltage feedback with IR drop compensation, a constant generated armature voltage is maintained through the control elements operating on the armature rectifier. A current feedback from a current transformer in the armature supply determines the rate of motor field strengthening during reel build-up. The rate is such as to maintain essentially constant armature current. Since both the armature voltage and current are constant, obviously horsepower input is constant. In cases where tension is extremely critical, or gears introduce considerable losses, a direct tension measuring device, such as a dancer roll, must be used as a feedback element. A solenoid usually is connected to the dancer roll as an electrical signaling element.

8. Re-Reeling for Inspection

The second common type of reeling application is in the re-reeling of the fabrics or wires for inspection, or finishing operations. The control is primarily a speed control, using a tachometer to measure the linear speed of the material and provide the primary feedback means. Control usually is applied to the reeling motor, and tension is maintained by a drag generator, drag clutch, or some other hold-back method.

For instance, in one application a reel of annealed strip steel is wound at approximately constant tension. Constant-horsepower input to the reel motor is maintained through the reel build-up.

Slight modification of the constant-horsepower principle is sometimes used, calling for decreasing input as the reel diameter increases. This automatically provides for less tension as the reel diameter increases and makes a better roll, the material being wound more tightly at the core. In the application referred to previously, the strip is taken directly from the annealing oven. Hence, the speed of the strip is determined by the output of the oven.

Similar applications are found in every wire or strip processing mill. The advantages are better control of tension and a more uniformly wound reel, and elimination of a slip clutch or other type of mechanical driving mechanism.

A typical re-reeling application is found in the manufacture of wire rope. The individual steel wires are drawn to diameter and left in loose wound forms or coils. These coils are welded or brazed together and wound into larger coils on bobbins. Length of wire on a bobbin varies from several thousand feet up to several miles. During this rewinding process, it is desirable to maintain the maximum safe wire speed.

Former conventional wire-winding equipment used a constant-speed motor to drive the bobbin. Obviously if the bobbin is run at a constant speed the wire speed increases as the bobbin builds up. Maximum safe operating speed is then determined by the wire speed with a full bobbin. Before the wire rewinding equipment shown diagrammatically in Figure 3 was installed, the wire speed was 330 feet per minute, with minimum diameter, and 800 feet per minute with a full bobbin, the average speed being on the order of 600 feet per minute.

After installing electronic variable-speed control equipments, the maximum winding speed could be increased to 1500 to 2000 feet per minute and maintained constant throughout the full build-up range of the bobbin.

The reasons for such improvement are twofold. First, the electronic drive equipment provides a smooth, easily operated control permitting higher operating speeds as well as providing automatic field strengthening to maintain constant wire speed. Second, and more important, an electric drag generator replaced the former mechanical friction brake, permitting higher operating speeds.

For this application, the feedback voltage is obtained from the drag generator armature. This voltage, for any given tension, is proportional to wire speed.

Another advantage, also leading to greater output, is that the wire can be wound tighter and more uniformly on the bobbin, increasing the weight of wire from 10 to 15 per cent. Also, elimination of the drag clutch and associated mechanism greatly reduced the maintenance expense as well as simplifying the operation.

9. Milling Machines

Another interesting type of application is automatic control of the load on a motor or group of motors, which may be accomplished most easily by closed-cycle motor control. An example is the use of electronic motor control on the feed drive of a milling machine.

This equipment was developed to machine the fins in a forged aluminum aircraft engine cylinder head. The contour of the head was such that the depth of cut might vary between zero and maximum depth of fin, with no two cuts alike.

A constant feed rate, suited to the deepest cut, would mean that when the depth of cut was a minimum, very little material would be removed and the cutter motor would be lightly loaded.

The ideal solution from the production standpoint would be to vary the feed rate automatically, using a high-speed rate where little material was being removed and a lower speed during maximum depth of cut. Then the cutter would be removing the maximum amount of material, and the cutter motor would be loaded to full capacity.

To accomplish this, a current transformer was placed in the power lines to the cutter motor, to measure the load. The current transformer, serving as the primary feedback element, in turn controls the feed rate, maintaining a pre-set load on the cutter motor and achieving the maximum milling rate. With this adjustable-speed feed drive, the output of the fin milling machine was increased by 35 per cent.

The same control principles may as readily be used to maintain constant load on grinder motors in cement or feed mills, or to maintain maximum output in a sawmill, or on numerous machine tools.

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CONTROL BOARDS CUT WRITTEN

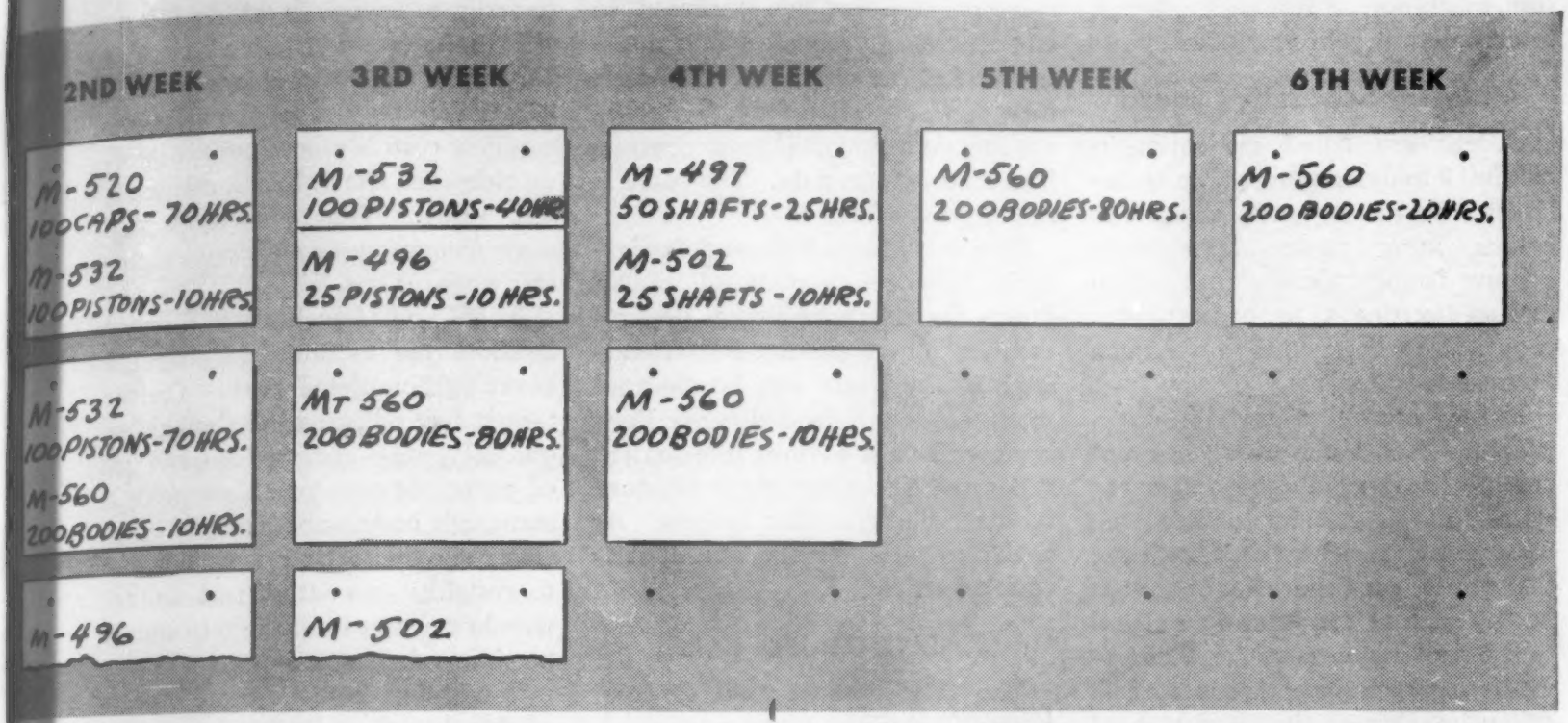
What is happening in production—and why. The control boards tell all. And it takes just one girl to run them

EDWIN W. KING • PRODUCTION MANAGER, HYDRO-POWER, INC. SPRINGFIELD, OHIO

THREE wall charts provide quick answers to cost and production control problems in the 100-man Hydro-Power plant. Use of this system has eliminated three-fourths of the reports that usually seem to be attendant on and necessary to management control.

1. Machine Load Board

To control loading of machine tools, a machine load board lists machines available in the left column; weeks across the top. Six weeks' advance loading can be scheduled. In the weekly column, opposite a particular machine, are hung cards (on two nails) which carry the order number, pieces on order, and estimated hours for completion. Sufficient cards are hung on each week's hook to make up 80 hours of full production. The plant operates two 40-hour shifts per week.



THE LEFT COLUMN; WEEKS ACROSS THE TOP. CARDS CARRY NUMBER OF PIECES ORDERED, ESTIMATED HOURS FOR COMPLETION

DATE MATERIAL ORDERED	MAT'L REQ. FOR MFG. %	DATE DUE ←	MACHINE WORK %	DATE DUE ←	PURCHASED MATERIAL	DATE DUE ←	ASSEMBLY AND TEST	DELIVERY DATES	DEMANDS NO. ACTUALLY SOLD
7-14-47	10-6-47 100%	9-29-47	100%	12-1-47	10-13-47	12-1-47	12-10-47	12-15-47	~~36~~ 39
8-4-47	10-6-47 100%	10-13-47	100% 12-11-47	12-5-47	11-3-47	12-5-47	12-12-47	12-16-47	~~30 52 62~~ 74
8-6-47	10-16-47 100%	10-6-47	87%	12-22-47	11-4-47	12-22-47	12-30-47	1-8-48	96

DATES. CARDS OF VARIOUS COLORS REFLECT ALL INFORMATION PERTINENT TO EACH ORDER FOR QUICK REFERENCE

REPORTS 75 PER CENT

For example, follow the loading of machine 521 on the chart. Job M532 requires 150 hours on the machine. Eighty hours can be scheduled in the first week and 70 hours in the second. Job M560 comes next. It requires 100 hours. Ten hours complete the second week; a full 80 hours complete the third; and the remaining 10 hours are carried into the fourth week.

When this operation on Job 532 is completed, the control card is removed and filed. Then the following operation cards are advanced by weeks, and the board is current again.

Thus the chart indicates machine backlogs and the relative status of operations. If an urgent repair order comes through, the board will show where substitution of orders can best be made.

Another advantage results from use of the board. One man can supply all machines with stock. Each morning he consults the board to determine stock needed by each machine for the day, then delivers that stock supply. He no longer has to check route cards and stock pans to see what goes where.

When either absenteeism or machine breakdown is reported, a red card (shown in green in illustration) is hung in the first column opposite the machine affected. It's a trouble signal for the superintendent, who then reshuffles opera-

tors, machines, or jobs on the board to complete urgent work first.

2. Master Scheduling Board

Orders are listed on cards in column 2 in descending order of delivery. In effect, cards of various colors, hung under appropriate column headings, reflect all information pertinent to a particular order. No reference to voluminous records is necessary.

If, for example, material in manufacture for order M605 has not completed machining by the required due date (refer to chart, line 3, column 8) a red card is hung over the white card on the operation hook (column 7). This is a signal to the production manager that immediate corrective action is needed. When machining is finally completed, the original white tag is placed on top of the red tag. Then the lower right corner of the white tag is clipped to allow a portion of the red tag to show (see line 3, column 5—material was late). All pertinent facts about the delay are noted on the red tag as a record.

As an order is completed, all cards pertaining to it are removed from the line and discarded. Cards for remaining orders are then moved up.

This board has the advantage of unlimited time coverage, depending upon the manufacturing cycle of any order. Job activity moves from left to right with time.

Responsibilities are assigned to engineering, purchasing, and manufacturing departments on each order. Upon scheduling, the engineering department promises drawings on a certain date. That date is noted on the board.

Similarly, the purchasing department promises a material arrival date; the manufacturing department, a job completion date. Headings on the board can be changed readily, as can jobs and cards. Each hook will hold several information cards and a warning card. No dead files accrue from this system. As each job runs off the board, it is considered closed.

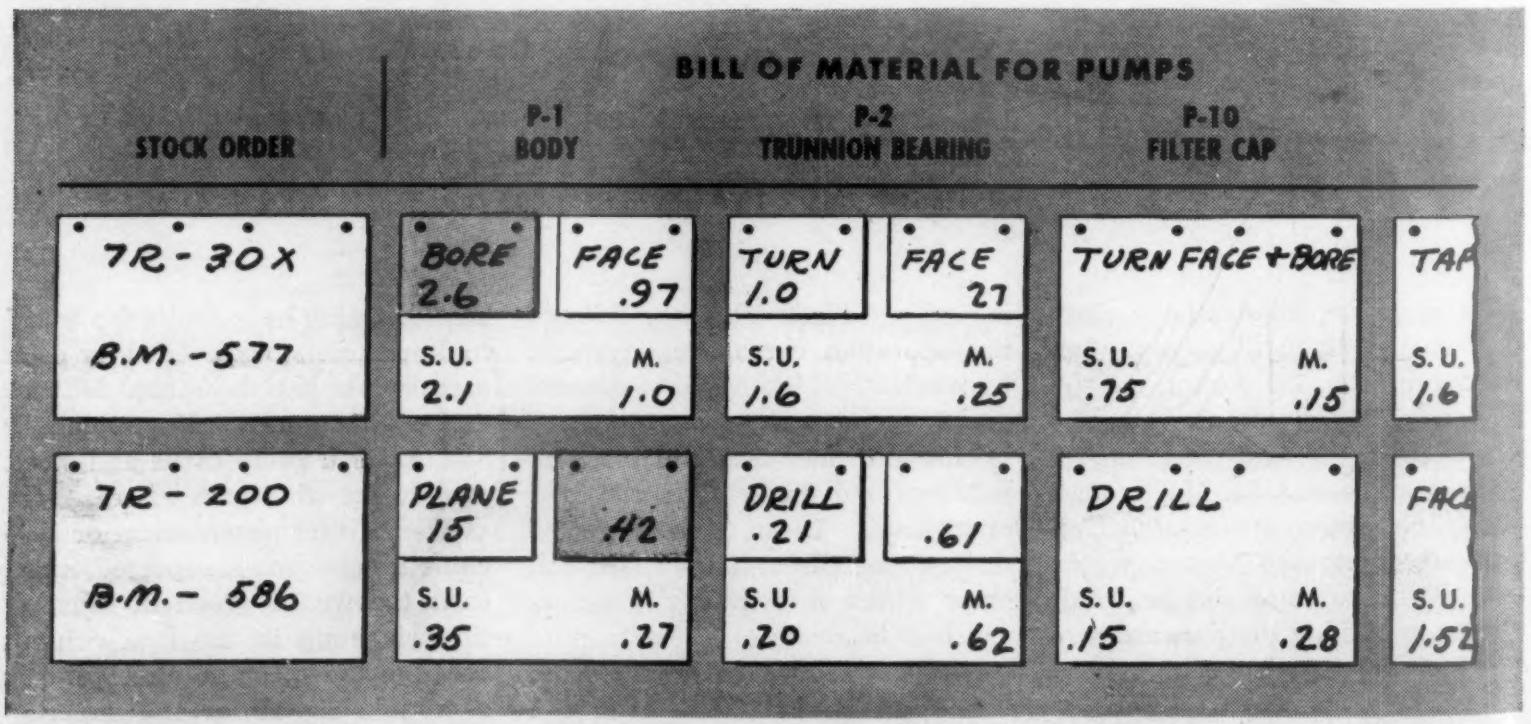
3. Cost Control Board

The third board, used for cost control, provides a constant check on each part of each order. In the stock order column, cards are hung on successive hooks for each type of assembly. In line with a particular type and under descriptive column headings are hung white cards for each operation on every part. In addition to operation description, each card carries standard set-up hours and machining time per piece.

If actual set-up time exceeds the estimate, a half-size red card is placed over the set-up side of the card indicating an overage (see chart, line 2, column 2, right side). If, however, actual time is within 20 per cent of the estimate, a green card is placed over the set-up side to indicate that it is within allowable limits (see chart, line 2, column 3). If the time saving is more than 20 per cent as against the estimate, a yellow card is placed over the set-up side (see chart, line 2, column 2, left side). This procedure also governs overages or savings on machine operations.

At the end of each week, a report is submitted to the plant manager covering completed parts. On the report are indicated the shop order, quantity, parts descriptions, end use of parts (as part of an assembly), standard costs, and actual costs. Costs shown to be out of line are thoroughly investigated to see whether or not the base rate should be changed.

In addition to cost control aspects of this board, it performs another vital function. Its records are maintained in such a manner that the operators performing operations can be identified over a period of time. It is therefore possible to keep tabs on which operators are responsible for the presence of red or yellow cards on particular operations. If one operator consistently causes delay on a certain operation, and if other operators can meet the standard for that operation with little difficulty, the indication is that that operator should not be scheduled to perform that operation. The net result is an excellent chart on performance of operators on widely divergent operations.



COST CONTROL BOARD. CARD FOR EACH OPERATION ON EVERY PART SHOWS STANDARD SET-UP HOURS AND MACHINING TIME

LOOKING AHEAD IN LABOR

Last-minute round-up as we go to press

If your production fits into the Marshall Plan, it's time to do some checking on Communist influences in your plant and in the union you deal with. You may have trouble ahead.

Remember the two years before June, 1941? Those were the days of the Hitler-Stalin non-aggression pact. Communists fought aid to Britain, pulled many strikes. North American, Allis-Chalmers, Alcoa.

We're entering a similar period with Marshall Plan aid to Europe. Communists fight it. They'll go the limit to undercut it. So watch out.

This is not idle theory. It's spread on the record in columns of the Communist *Daily Worker*. Philip Murray saw it coming. That's why he finally put the finger on CIO's left-wing.

A new party line has gone out to the faithful from the Communist National Committee. Significantly, perhaps, the *Daily Worker* didn't print it until five days after the committee met in New York. *As we see it, the new line means (1) more independence from CIO, (2) more strikes.*

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As to No. 1 (we quote): "During the first two years of the post-war period we pursued—and correctly so—the tactic of the left-center coalition of the CIO. We failed to consistently develop an independent position. We did not maintain a sufficiently critical position towards our former allies..."

Righteous self-criticism, confession of failure. This usually precedes a new turn in the party line. Note also reference to CIO as "former allies."

Commies in CIO will go their own way. CIO policy for Marshall Plan aid and against Wallace's third party means nothing to heads of autonomous unions.

But look for more revolts by right-wing factions against left-wing leadership. It's already evident in the electrical workers, in some auto union locals.

State and local CIO councils, under national CIO control, have their orders—*opposition to CIO policy is against the rules.* Many heads will roll. Lee Pressman has gone. This marked the sharpness of the CIO split. In California, Harry Bridges goes. More will follow.

Now as to No. 2—more strikes. Again we quote the Party's National Committee:

"The Communists must recognize the special significance of the present round of wage struggles in this election year. There will be some among the trade union leaders who will fear the struggle...The pro-Truman, pro-Marshall Plan position of the majority of trade union leaders will inevitably influence them not to fight aggressively for the demands of the workers."

If ever there was an order to the Commies to resist efforts of union leaders for peaceful settlements with management, that's it. Is trouble ahead for many labor leaders? And many managements?

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Watch UE-CIO, biggest left-wing union, in third-round negotiations with Westinghouse, GE, GM. It sets the pace for smaller leftish unions. What it does may be the tip-off. In first two rounds, it settled with GM while Walter Reuther's auto workers still balked. Roles may be switched this time.

Break in grain market won't dampen third-round wage demands. Not unless it spreads and gives signs of holding. Even so, labor will insist on 10 to 15 cents.

John L. Lewis acts more and more like another coal strike is in the making. Washington fears one. Taft-Hartley can only stall it 80 days. But Cyrus Ching warns of other government action, even a stiffer law. He told southern coal operators: The country won't stand for another coal strike.

Speaking of Lewis, he's lifted the iron curtain on District 50 membership figures. District 50's newspaper reports: 1000 locals, 160,000 dues-payers.

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Congress won't set up a labor extension service this year. Despite hearings, it's not on list of laws Republicans expect to pass.

Politics gets hotter every month. Victory of Wallace's man Isacson in Bronx has Democrats and CIO's PAC worried, raises hopes of Republicans. Here's what happened: *The Communists voted; Democrats didn't.*

Wording of Taft-Hartley ban on political spending may be revised if courts find it curbs political comment in union newspapers. Congress didn't intend that. Murray's acquittal on constitutional grounds would not be surprising. Indictment has one strong point: Murray's endorsement in *CIO News* was distributed free—like campaign literature—in Baltimore.

What's this Taft-Hartley law doing? During last four months of 1947, AFL membership rose 18,000 to peak of 7,800,000. Teamsters claim 75,000 new members.

LOOKING AHEAD IN BUSINESS

Last-minute round-up as we go to press

When will we say: "This is it"?

Last month's break in commodity prices was quickly assessed as "healthy." It helped bring high-flying food prices into line; it eased pressure for third-round wage increases. But it posed three important questions: *When will business decline? How far will it go? How soon will it come back?*

Chances are that the drops in commodity markets have postponed any slowdown in industrial activity beyond this year. But the longer the boom goes on, the deeper may be the decline that comes after it.

Here's why, in a nutshell: The props that put a "floor" under business, limiting any drop in activity, are strong now. *But they are not as strong as they were a year ago, and they are stronger than they will be a year from now.*

Business expansion, for example, now running at a rate of $16 billion a year, will hold high this year, no matter what. But next year business will be much more likely to chop plant and equipment spending.

Demand for automobiles will keep Detroit going full tilt this year, even if there should be a decline. But next year customers will be much more able to postpone their buying. Across the board, supplies of consumer goods are coming closer to meeting demand. *So the longer the boom goes on, the less we can be sure that a decline would be mild and short.*

Point of all this: 1949, not 1948, is the year to worry about in the business outlook.

Even then, however, there are lots of reasons for hope. Business is stronger now than after World War I, if for no other reason than that we are taking our bumps one at a time and not all at once.

If we can correct the worst of our current food-price inflation while capital expansion is still high, we'll be in better shape for whatever 1949 may bring.

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International developments may result in higher military spending. And that would bolster business in 1949, too.

Take a look at Palestine: We may be sending U. S. arms — and possibly U. S. troops — there after May 15 to enforce partition.

Greece, too, is likely to soak up far more money and material than the U. S. has counted on.

China, also, worries U. S. military strategists.

All of which means — look for higher, not lower, military budgets. Military chiefs are reported to have already told Congressional leaders that they'll be asking more than $15 billion next year.

Items in the bill: Air power — the Finletter Air Policy Committee recommended raising today's $4 billion air forces budget to $7.1 billion in 1949 and on up to $10 to $12 billion in 1952. Higher pay for servicemen, appropriations to activate service reserves, production of new equipment such as tanks with integrated radar and fire control, stockpiling of strategic materials — all add to the budget. And all will show up in business's tax bill.

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Production in Europe is picking up. Late 1947 saw Belgium producing 82 per cent of what it did in 1937, France 89 per cent, Great Britain 110 per cent. Italy was back to 72 per cent of pre-war, the Netherlands 91 per cent. But over-all steel production in Western Europe was only 63 per cent of the 1937 rate, total hard coal production about 84 per cent.

Even if Europe's pre-war plant were going full tilt, it wouldn't be enough. Her population has shot up — by an estimated 21 million. Much of today's production must be plowed back into rebuilding and expansion. Key shortages chase each other in vicious circles. Food shortages, for instance, slow coal production. And lack of coal cripples output of nitrogen fertilizers needed to boost food production. The Marshall Plan will help break them.

Even the Marshall Plan, though, big as it is, cannot guarantee full recovery.

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Look for easier money, easier credit this summer. The Treasury's drain on the money supply, through tax collections, is now at its yearly peak. Inventories, too, are at a peak. Business will not have to keep on increasing its borrowing to build them up. Tricks like cutting into this year's surplus to finance part of Marshall Plan reduce deflationary effects. *It helps make pattern of government money policy what it was last year — mildly deflationary in first half, inflationary in second half — and that gives business a lift through this year.*

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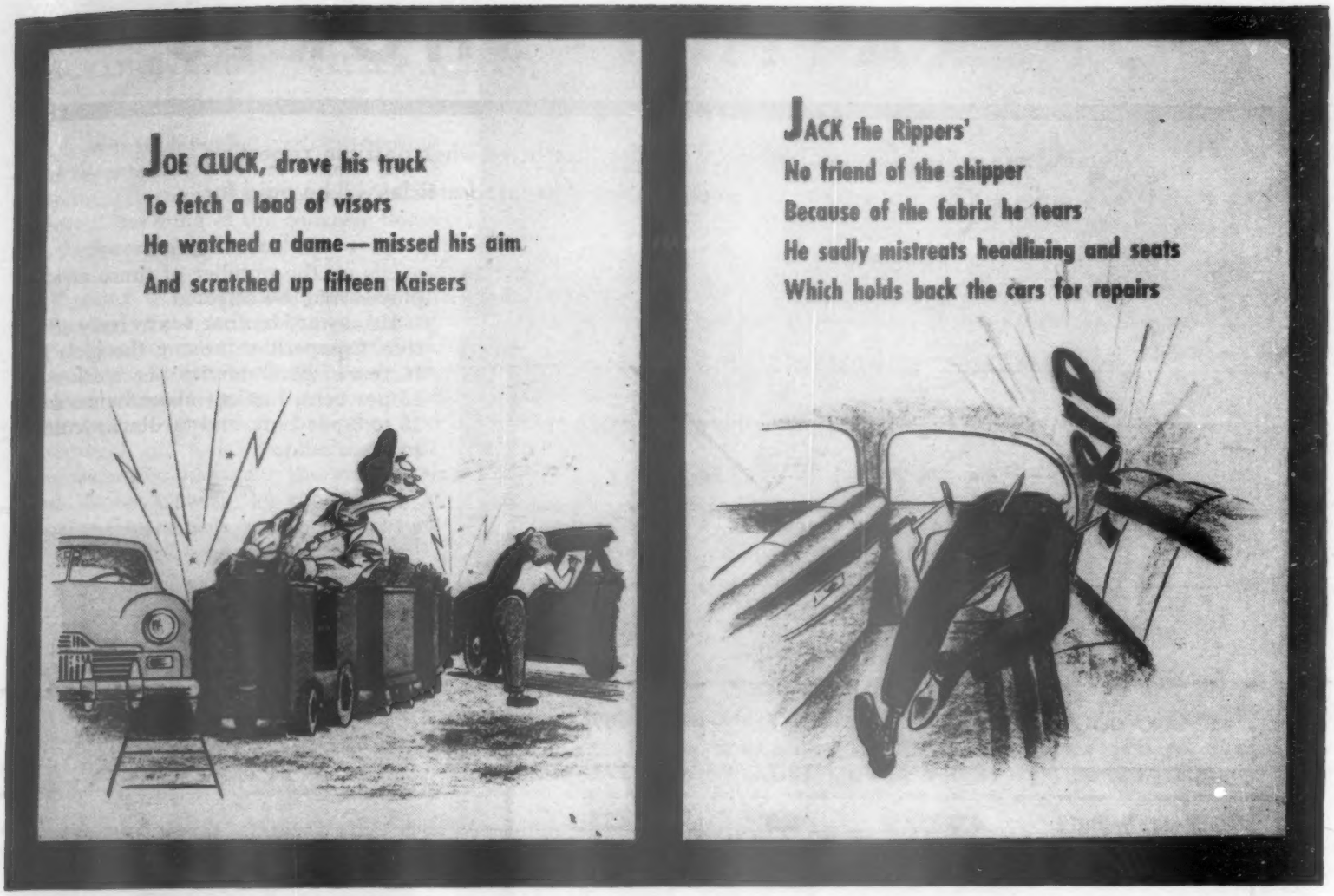
How great the U. S. is among the world's producers is revealed in a United Nations survey. Ten years ago, the U. S. produced a little more than 40 per cent of the world's steel. Today we are producing almost 60 per cent. Our steel production is more than double all Europe's. Much the same story applies to most basic commodities. Only with our vastly expanded contribution do the world's production levels approach pre-war.


JOE CLUCK, drove his truck
To fetch a load of visors
He watched a dame—missed his aim
And scratched up fifteen Kaisers
JACK the Rippers'
No friend of the shipper
Because of the fabric he tears
He sadly mistreats headlining and seats
Which holds back the cars for repairs
rip

THESE POSTERS DON'T PREACH, BUT THEY PROVED SUCCESSFUL IN REDUCING FINISHED-CAR REJECTIONS AT KAISER-FRAZER

LIMERICKS CURE CARELESSNESS

Orders are easier to take when they are sugar-coated—hence the effectiveness of this limerick-plus-cartoon campaign

CATCHY limericks provided the basis for an unusually successful poster campaign directed against carelessness of workers on body building and final assembly lines at Kaiser-Frazer Corporation, Willow Run, Mich.

KF's problem was one that is common in the automobile industry. It is the considerable expense and delay involved in repairing body digs, metal scratches, upholstery tears, and other imperfections in finished cars.

A comprehensive study disclosed that 90 per cent of this damage was the result of carelessness on the part of workers—carelessness involving handling of sharp tools, inattention to the job, failure to wear shop aprons which cover car-scratching belts and other apparel, horseplay, and kindred factors.

The solution to the problem obviously lay in informing the workers in the body and final assembly divisions of this condition and its causes, and selling them on correcting it. Above all it was recognized that the job had to be done without preaching—a pitfall that accounts for the ineffectiveness of many in-plant poster campaigns.

Humor Pays Off

Accordingly the KF message was cloaked in a series of plant posters combining humorous cartoon-character artwork with entertaining but meaningful limericks.

In planning the drive, a few typical causes of minor car damage were taken one by one, and limericks were composed about them. The limericks were then turned over to an artist who drew cartoons to illustrate them.

Workers were invited to submit their own limericks for use in the poster series. More than 500 were turned in. Automobile accessories —radio, air conditioner, and seat covers—were awarded to writers of the three best entries. Posters were changed periodically, so that no single one had a chance to get stale before it was replaced by the next one in the series.

Within days after the poster drive opened there was a noticeable drop in the number of cars rejected for avoidable damage. Two weeks after the campaign started such damage had decreased some 70 per cent, and by the conclusion of the drive minor post-manufacture repair work had dropped to the minimum.

OPERATING SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary operating accomplishments. Accepted articles will be paid for.

HELMET DEPARTMENT

DAILY POSTING SHEET FOR INCENTIVE WORKERS

Week Ending January 10, 1948

Operator	Hours on Incentive	Monday: Hours Earned	Per Cent Performance
ALFRED ROBEY	8.0	11.1	139
JOE BAKER	8.0	10.0	125
RICHARD DOGE	8.0	11.1	139
JACK GEORGE	8.0	13.7	171
GERARD MUNTZ	4.0	5.0	125
ROBERT DAVIS	4.0	4.4	110

DAILY EFFICIENCY SHEET KEEPS WORKERS ON TOES

Daily efficiency ratings for each worker at Willson Products Inc., Reading, Pa., are posted in every department for all to see. Used in conjunction with the company's incentive plan, this idea serves to keep workers on their toes. Competition between individuals acts as a stimulus, and interest in productivity has been increased. So has departmental morale.

Questions that formerly remained in the backs of the workers' minds have been brought into the open by this plan. For instance, workers newly placed on incentive naturally questioned the rates and comparative productivity of individuals with whom they worked. When these questions are raised now, members of management carefully explain the answers.

Workers benefit in other ways, too. Daily posting of their ratings shows up subnormal operators and allows foremen to concentrate their attention upon them. It allows an individual to become adjusted to his job more easily, since he soon learns to have confidence in management's approach to the productivity problem.

Now workers have come to expect this daily posting by the standards department. From it they can estimate their daily and weekly pay to the penny. Each operator knows his own rate, and can interpret his performance percentage into dollars and cents.

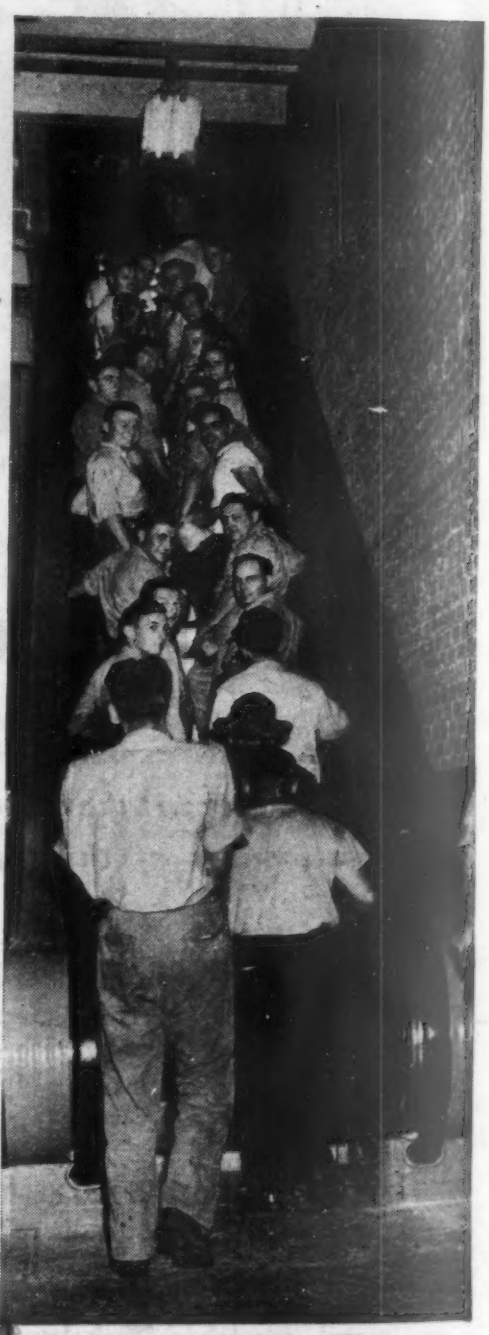
BOND AWARD REDUCES TARDINESS, ABSENTEEISM

The "Girl-of-the-Month" award for over-all efficiency at the Connellsville Sportswear Company, Connellsville, Pa., is a $25 bond.

To be eligible for this award, the employee must have met the following conditions: (1) No tardiness; (2) no absence from work; (3) not over 5 per cent rejection of inspected work; (4) no friction in contacts with her fellow-workers; (5) no make-up in wages. (The plant operates on a 65c hourly minimum wage. Each girl is on piecework. Therefore, if a girl earns only 50c per hour during the month, the company is obliged to make up the 15c balance.)

At the end of each month, foreladies recommend one or more candidates from their sections who satisfy all requirements. The candidate with the best over-all record is elected the "girl-of-the-month" and is presented in a meeting with a $25 bond. No limit exists on the number of times an employee may be selected.

This award has been extremely effective. Competition among the girls has increased productivity per worker by 15 per cent, has cut absenteeism from 15 to 3 per cent, and tardiness from 30 to 5 per cent.



A QUICK, COMFORTABLE RIDE between floors is provided employees of Buick's new sheet metal building at Flint, Mich. The four-story building, a half-block wide and nearly 1600 feet long, is equipped with what may be the first factory installation of escalators in the country. Now confusion and crowding on stairways, with the accompanying accident hazards, are eliminated, and workers save both time and energy

RADIANT HEAT STOPS FLOOR BUCKLING UNDER FREEZER

SOURCE: A. M. Byers Company, Pittsburgh

A system of modified radiant heating has been installed at the Adams Apple Products Corporation of Aspers, Pa., to prevent buckling of the concrete floors in the freezing and refrigerated storage rooms.

Frosting of the ground underlying structural slabs is a common hazard where low temperatures are employed. Numerous instances have been recorded where, despite the amount of intervening insulation between the structural and finish floor slabs, frost has accumulated under the structural slab. In such cases the concrete floor frequently buckles, and over a period of time is destroyed.

In the Adams plant the structural floor slab, the layer of insulation, and the finish floor slab are 6 inches thick each. During the early stages of construction coils of ½-in. wrought iron pipe spaced on 36-in. centers in grid pattern, were buried in the structural slab.

The coil headers were connected with the proper controls to the customary steam heat exchanger and fluid circulator. Instead of using water protected by an antifreeze compound, however, the designers selected No. 2 fuel oil as the heating medium.

The oil is kept at a temperature of about 40 deg. F., which is sufficient to prevent freezing of the insulation even with a room temperature of minus 30 deg. F. The radiant heat, however, does not penetrate the finish floor slab.

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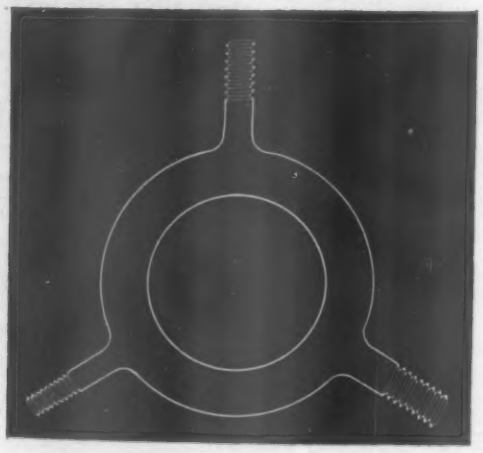


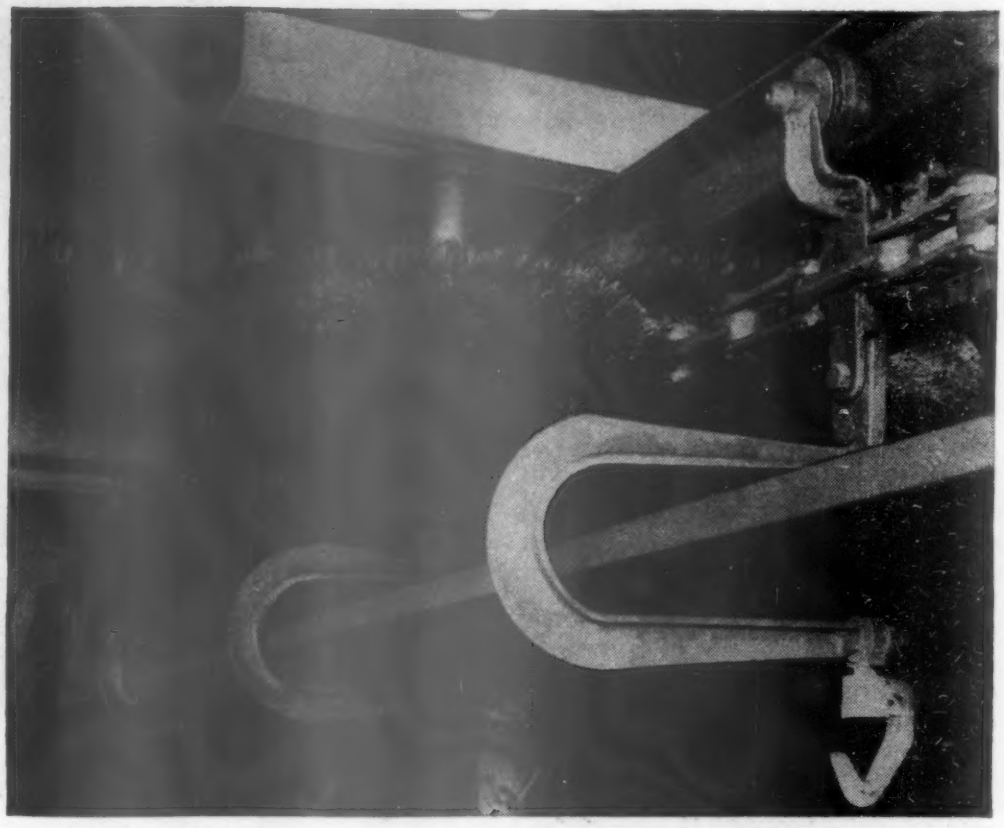
THREE-IN-ONE EYEBOLT FOR MACHINERY REPAIRS

FRED A. WALTERS, Maintenance Superintendent, The Goss Printing Press Company, Chicago

We find that the three-in-one eyebolt illustrated here can be used in many ways in our machine repair department. It was originally designed by our blacksmith shop foreman, Donel Meyers, for lifting jigs and fixtures in the milling machine and drill press departments.

Two of these eyebolts serve the purpose of six separate eyebolts, ranging in thread sizes of ½, ⅝, ¾ inch and ⅞, 1, 1¼ inches, respectively. These sizes give a safe lifting range from 500 to 3000 pounds. In use, the lifting chain is attached to the side of the ring opposite the bolt being used.

The three-in-one bolt not only saves space, but also saves time wasted in looking for the proper eyebolt to fit the job.



Circular wire brushes installed on both sides of the conveyor chain move with the chain and keep up a continuous cleaning process, removing scale deposits, excess grease, and accumulated dirt

CONVEYOR CHAIN CLEANED WITHOUT HALTING WORK

SOURCE: The Osborn Manufacturing Com-pany, Cleveland

A technique that reduces conveyor chain maintenance costs and offers substantial savings in operating and maintenance efficiency is being used in the refrigerator plant of the General Electric Company, Erie, Pa.

Two disk-center circular wire brush sections, 15 inches in diameter which passes through a rust-proofing solution at one stage of the assembly process and containing 0.014 wire, are mounted on each side of the conveyor chain. These brushes are in contact with the chain just after it emerges from the bonderizing bath. Not only do they clean off the scale deposits, but they also remove grease, oil, and dirt which is likely to accumulate in the regular course of service.

Prior to the introduction of the brushing method of descaling the chain, it was necessary to halt production periodically, remove the chain from the conveyor, and clean it in a caustic solution.

No special power mechanism is required to operate the brushing operation. The brushes revolve with a chain, cleaning it continuously as the production line moves.

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INDIVIDUAL MOTORS FOR QUICK MACHINE CHANGES

Because of seasonal changes in style and the resulting alterations in production procedure, frequent layout revisions, usually at least four a year, are required at Charis Corporation, Allentown, Pa., makers of foundation garments for women. A recent change allows this to be done quickly, with very little lost time.

The old method involved sewing machines which were fastened to stationary metal legs. They were powered by a large motor driving a 35-ft. shaft. This arrangement made the layout inflexible. When a machine had to be moved into another place in the production line, it took about 30 minutes to do the job. The sewing machine heads couldn't be moved without the tables, because the table tops had specially shaped cutouts and various kinds of bases.

Now each machine is individually motorized. Although the work trough remains stationary, machines and tables on each side can be moved. When a major style change takes place, and the sequence of operations is

altered, it is necessary only to unplug the motors, and wheel the tables into their proper position in the line.

Straight-line production is now a simple matter. Lost time for operators and mechanics caused by layout changes is greatly reduced, and maintenance work is less costly and easier to perform.

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PAINTING SERVICE PIPING FOR EASY IDENTIFICATION

PHILIP F. ATWOOD, 471 North Maple Ave., East Orange, N. J.

When repainting plant interiors, it is time consuming and expensive to paint all the service pipes with coded colors. Furthermore, many plant executives do not like the rainbow display of color which many service lines would require. However, if they are all left the same color as the walls and ceiling it is often difficult to trace out the service carried.

A satisfactory method of eliminating this condition is to paint only the fittings in coded colors. This allows the painting to be done most economically, and without the confusing effect of the many colors. Yet each line of piping can be quickly identified.

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A COLLAPSIBLE AND PORTABLE steel frame and dock cover protects employees loading or unloading freight cars from bad weather and cold, at Personal Products Corporation, Milltown, N. J. It is designed to be placed easily and quickly into such position that it effectively closes the drafty gap between the car and the enclosed platform. When the freight car door has been aligned with the opening on the shipping or receiving dock, the dock cover is wheeled down the dockboard into position, and one end of the frame is extended until it is flush with the freight car

As part of their orientation trip, the plant superintendent explained to this group of office workers the working of an auger machine, which extrudes flue linings, here shown being cut to specified lengths

ORIENTATION PLAN BASED ON TOUR OF PLANT

Not long ago a secretary at The Robinson Clay Product Company, Akron, looked up from her work to ask one of the company officials, "What in the world are clay flue linings?" Soon after that, she found out. In fact, she watched the whole process of manufacture, from the molding of the clays to the final firing process.

The company put into operation an orientation plan designed to acquaint its 1500 employees from eight plants and sixteen branch offices with its operations.

Thirty-five stenographers and secretaries started the ball rolling when they were given the afternoon "off." They were dined by the company at a local restaurant. A chartered bus picked them up there and carried them 40 miles to the Robinson Refractory plant at Parral, Ohio. Here they were divided into three groups, and taken through the entire plant by company officials. These men had been notified in advance so that they had plenty of time to prepare talks that would not be too technical. The girls were told to ask questions about anything they didn't understand.

The trip required about four hours. The result: The girls' morale jumped almost overnight. Now they feel they are closer to the business, more a part of the company. And they know the difference between a periodic kiln and a tunnel kiln, something the male force in the office is thankful for.

The company plans to continue this "education" program. When employees understand the other fellow's job, they respect his position, and it makes for better teamwork all the way down the line.

MAGAZINE RACK HELPS EDUCATE EMPLOYEES

D. P. CADY, General Superintendent, Esterbrook Pen Company, Camden, N. J.

As a small part of its efforts to educate its factory personnel, this company makes available to them all the business publications and magazines to which it subscribes.

A maple-finished magazine rack, 53 inches high and 47 inches wide, has been placed in the second-floor hallway just outside the ladies' smoking room. This location is a crossroads of employee traffic. The rack has 25 bins, each capable of holding a pile of 8 to 10 issues of the publications. Directly over the rack is a sign in carved wood lettering, which reads, "Pass It Along."

When publications first arrive, they are routed to all members of management who have a direct interest in the subject matter. Then the magazines are placed in the rack. Once they have reached this rack, employees are not only permitted, but also encouraged, to take them home, even if they don't return them.

The response is justifying the effort. It is surprising how many of the women workers show an interest in the business publications.

YALE FORK TRUCK

WHEN CHOOSING A TRUCK *BE SURE* IT HAS

YALE WORKSAVER

DEPENDABLE POWER

EXIDE-IRONCLAD BATTERIES

have lifting power, hauling power, lasting power . . . when you need it, as you need it, and straight through every shift. This extra power of Exide-Ironclad Batteries is due to a unique construction, which differs from that of all other batteries.

One notable difference is in the positive plate, which consists of a series of slotted tubes containing the active material. So fine are these slots that, while they permit easy access of the electrolyte, they retard the active material from readily washing out.

The results are High Power Ability, High Electrical Efficiency, Ruggedness, Long Life and Low Maintenance. Only Exide-Ironclad Batteries have ALL FOUR of those vital characteristics.

For peak performance and maximum economy, choose the batteries that 81.1%* of electric industrial truck owners prefer—Exide-Ironclad Batteries. **From a recent survey by a leading business publication.*

Write for further particulars and FREE copy of Exide-Ironclad Topics, which covers latest developments in material handling and shows actual case histories.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

maintenance data sheet 149

CAUSES AND REMEDIES FOR TROUBLES WITH D.C. ARC WELDERS

CAUSES	WHAT TO DO	SCHEDULE OF PREVENTIVE INSPECTIONS MIN.	MAX.
MACHINE FAILS TO HOLD THE WELDING CURRENT CONSTANT			
1. Rough or dirty commutator	True or clean commutator	3 mos.	1 yr.
2. Brushes worn down to limit of adjustment or life	Replace or readjust brushes	2 mos.	1 yr.
3. Brush springs lost tension or broken	Check brush spring tension. Replace or readjust brush springs	2 mos.	1 yr.
4. Field circuit has variable-resistance connection or intermittent open circuit, caused by loose connection or broken wire	Check field current with ammeter. This applies to both the main generator and exciter, if used	*	*
5. Electrode lead or work lead connections poor	Tighten all connections	1 mo. (if leads are not removed)	6 mos.
6. Wrong grade of generator brushes	Check with manufacturer's recommendations	*	*
7. Field rheostat or tap switches make poor contact or overheating	Inspect rheostat, clean, and adjust finger tension on switches	6 mos.	1 yr.
8. Current control brush holder contact springs worn out or bent. Contact surfaces dirty, rough, or pitted	Inspect, replace defective parts, clean internal contact surface of control device. Do not lubricate. Smooth up roughened surface	2 mos. (very important)	8 mos.
9. Current control brush holder support stud and mating contact surfaces dirty or pitted and burned	Clean brush holder stud and internal contact surface—apply vaseline lightly to stud, and replace. If brush holder internal contact surface is burned, replace brush holder and support stud	2 mos. (very important)	8 mos.
10. Engine regulator rheostat shorting switch out of adjustment	Adjust switch contacts or mercury switch tilt angle so that circuit is open when engine is at full speed and when welding	*	*
II. MOTOR TRIPS OFF THE LINE			
1. Power circuit single-phased	Check for one blown fuse or dead line	*	*
2. Welder operating above current capacity	Check load against welder nameplate	*	*
3. Welding electrode or work leads too long or too small in cross-section	Check terminal voltage while machine is loaded; it should not exceed 30 volts on small machines and 40 volts on large machines when operating at rated current	*	*
4. Ambient temperature too high	See that temperature in motor-generator room or housing does not exceed 100 deg. F., and that there is no interference with normal ventilation of the machine	*	*
5. Motor input voltage too low under load	Voltage should not fall below 90 per cent of normal. Have power company check transformer and line capacity. Supply leads too long or too small should be corrected	*	*
6. Phase voltages unbalanced	Determine cause and correct	*	*
7. Ventilation impaired	Determine cause and correct	*	*
III. MACHINE FAILS TO START			
1. Power circuit dead	Look for open disconnect switch, fuses removed from clips, or blown fuses	*	*
2. Power circuit single-phased	Look for one blown fuse or one dead line	*	*
3. Power line voltage not suitable for motor, or extremely low. May be accompanied by chattering of starter	Check voltage particularly at moment of attempted starting	*	*
4. Machine jammed	See that armature turns over easily by hand. Look for foreign material in air gaps	*	*

CONTINUED ON PAGE 138

Prepared by John Morrill, Assistant to the Vice-President, The Lincoln Electric Company, Cleveland

Sinks its Teeth into a 50% Saving

SUN GEAR LUBRICANT...

Clings to Gear Teeth, Lasts Longer, Helps to Cut Lubrication Costs

A well-known New England mill had a chronic maintenance problem in the lubrication of a big gear train. Messy, black gear compounds were being used. They were hard to apply and didn't stay on.

To correct this situation a Sun Engineer was called. After checking all the factors involved, he recommended an extra heavy Sun grease with special adhesive properties.

A saving of 50% in lubrication costs has been effected since the Sun grease was adopted. The Sun product lasts longer, adheres to the gears and does not dirty up the mill.

"Job Proved" Sun lubricants are making records like this in scores of mills and factories in many parts of the country. They are helping to cut operating costs, to end maintenance headaches, and to keep machines in first-class condition. For full information and practical advice on lubrication, call your nearest Sun Engineer. Or write Department F-3.

SUN OIL COMPANY • ***Philadelphia 3, Pa.***

In Canada: Sun Oil Company, Ltd.—Toronto and Montreal

SUN
SUNOCO
INDUSTRIAL
PRODUCTS

maintenance data sheet 150

CAUSES AND REMEDIES FOR TROUBLES WITH D. C. ARC WELDERS

CONTINUED FROM PAGE 136

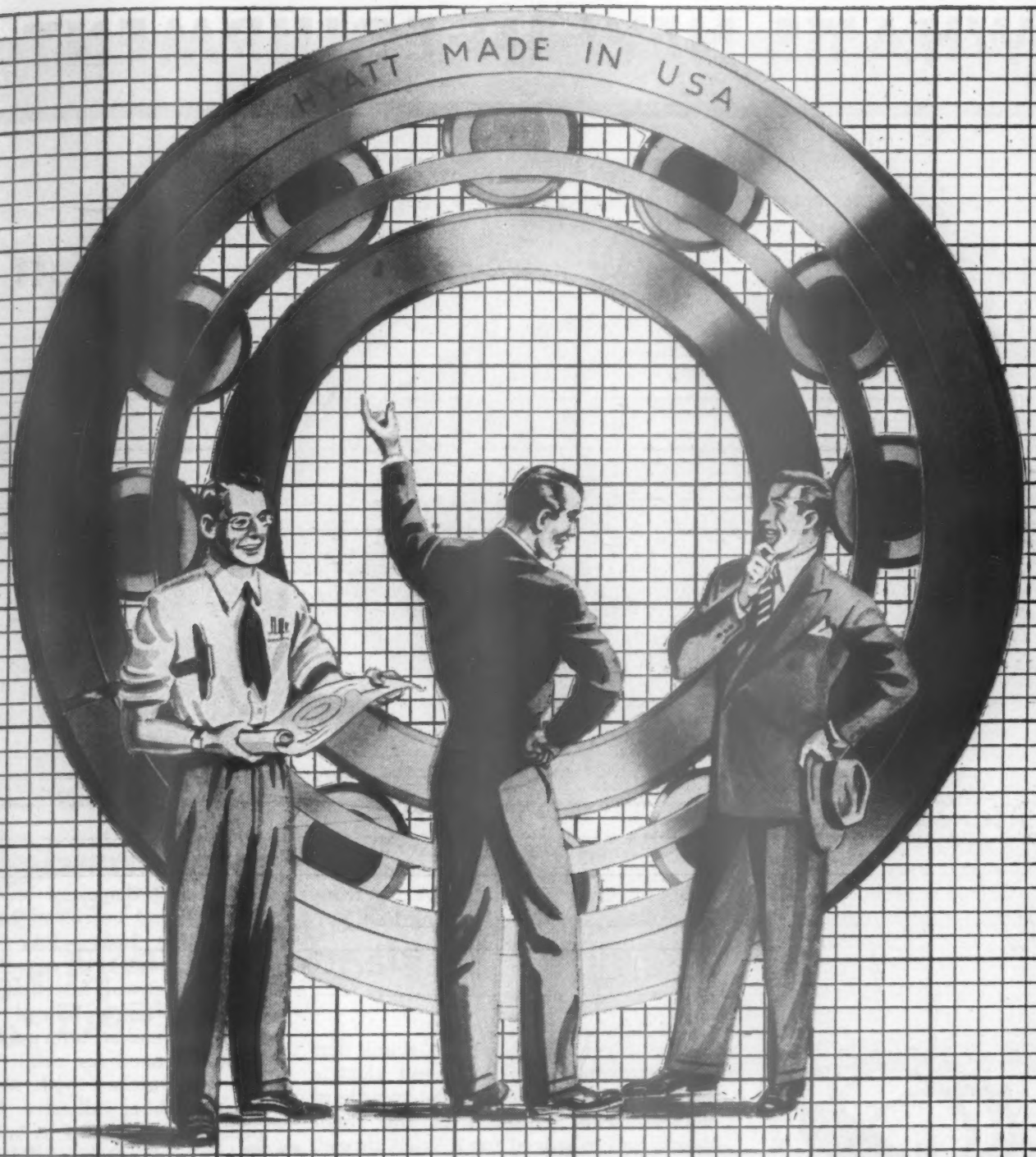
CAUSES	WHAT TO DO	SCHEDULE OF PREVENTIVE INSPECTIONS MIN.	MAX.
III. MACHINE FAILS TO START (continued)			
5. Motor starter single-phased	Check to see that all fingers on starter make contact when closed	3 mos.	1 yr.
6. Overload protecting device tripped or contacts open-circuited	If machine has had time to cool after tripping caused by overload, or is cold and starter fails to close, check for circuit through pushbutton, no-voltage release coil, and thermostats to find open circuit. See wiring diagram for normally closed and open contacts on pushbutton	*	*
IV. WELDER STARTS BUT FAILS TO GENERATE			
1. Running the wrong way	Check direction of rotation with manufacturer's instruction or direction arrow. On three-phase motors, direction of rotation may be changed by interchanging any two input leads	*	*
2. Generator or exciter brushes loose or missing	Be sure all brushes bear on commutator and have proper spring tension	2 mos.	1 yr.
3. Exciter not operating	Check exciter output voltage with voltmeter	*	*
4. Field circuit of generator or exciter open	Check for open circuits in rheostat, field leads, and field coils. Also check resistors and rectifiers, if any. Some machines give low output when fields are open	*	*
5. Exciter has lost residual magnetism	Flash the field** with a storage battery or another generator, first with one polarity and then with another to see if it builds up. (Flash exciter field if set has separate exciter)	*	*
6. Series field and armature circuit open-circuited	Check circuit with ringer or voltmeter	*	*
7. Reversing switch wiper contact bent and not clearing the blade of switch when switch is closed	Bend or replace to secure correct operation	4 mos.	1 yr.
V. WELDING ARC IS LOUD AND SPATTERS EXCESSIVELY			
1. Current setting too high	Check setting and current output with ammeter	*	*
2. Polarity wrong	Check polarity. Try reversing polarity, or an electrode of opposite polarity	*	*
3. Engine regulator shorting switch contacts close intermittently when running at full speed, causes increasing surge of current and spatter	Adjust so that contacts are well open or mercury level is well below contact on mercury tilt switch when engine is at full-speed position of regulator (bellows fully extended)	*	*
VI. WELDING CURRENT TOO GREAT OR TOO SMALL COMPARED TO INDICATION ON DIAL			
1. Current control shaft and handle turned slightly in the insulated bushing of current control brush holder, caused by turning handle too hard against stop	See that current control indicator yellow arrow is in horizontal position when handle is turned against stop in minimum direction	*	*
2. Exciter output low, causing low output compared to dial indication	Check for open circuit through field discharge resistor wired to reversing switch	*	*
3. Current control set to minimum and welder output so great that motor stalls when arc is struck	Determine if motor is running backward, or generator series fields are connected reversed to make a cumulative series generator	*	*

* These causes cannot be prevented, nor the harmful effects lessened in degree, by any system of preventive maintenance inspections.

** Flashing the field of a generator or exciter is a method of establishing the residual magnetism of the field structure with the proper polarity to cause the machine to build up or generate voltage. It consists of passing a relatively high current through the field windings momentarily, using an external source of direct current to supply the power. If the machine has a separate exciter, flash the exciter field by applying voltage to the brush holders after lifting the brushes on one side of the commutator, closing the polarity reversing switch, and turning the rheostat to maximum field position. Follow the same procedure if the welder has no exciter. Use a storage battery, another welder, or any d.c. source up to 115 volts for flashing.

Prepared by John Morrill, Assistant to the Vice-President, The Lincoln Electric Company, Cleveland

WHAT'S NEW IN EQUIPMENT



THEY ALL AGREE ON HY-LOAD

THE BUILDERS

of today's finest equipment rely on Hyatt Roller Bearings to reduce friction and wear at important operating points. Because they have greater load carrying capacity . . . because their separable parts are freely interchangeable . . . because they are available in 10 major types . . . Hy-Loads help make possible more compact, more efficient, more economical design.

THE SELLERS

of today's finest equipment point out with pride that it's "Hyatt-equipped." With minimum care and maintenance, Hy-Loads outlast the equipment in which they are installed. Satisfied customers and freedom from service requirements mean profits for equipment dealers.

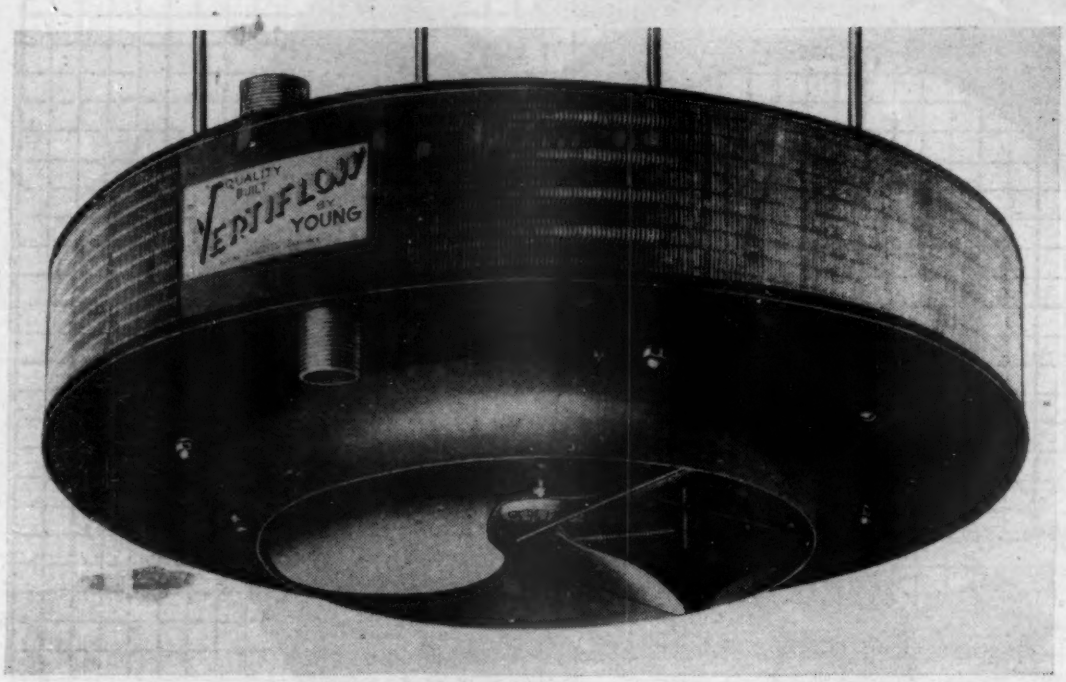
THE BUYERS

of today's finest equipment like the smoother, quieter performance . . . the reduced power requirements . . . for which Hy-Load Bearings are recognized in all types of machinery and equipment. For all-around satisfaction depend on Hyatt. Hyatt Bearings Division, General Motors Corporation, Harrison, N. J. and Detroit, Mich.

HYATT ROLLER BEARINGS

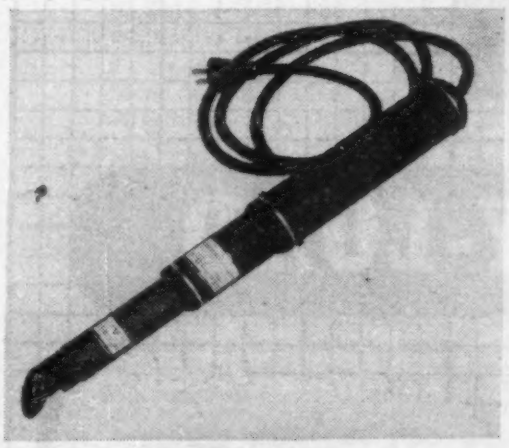
WHAT'S NEW IN EQUIPMENT

Briefed here—for the convenience of plant operating men—are descriptions of industrial plant equipment newly placed on the market



VERTICAL DISCHARGE HEATER

Motor of circular, vertical discharge-type unit heater features open-stack ventilation. It is mounted in a stack open at both ends, at the center of the circular heating core. Fans eliminate "motor baking." The heater comes in seven models, delivering from 52,600 to 552,000 B.t.u. per hour under standard operating conditions. Young Radiator Co., Racine, Wis.



HOLE INSPECTION LIGHT

Illuminating the bottom and sides of small, deep holes in machined or cast parts, a light facilitates inspecting holes of ⅛-in. diameter, 6-in. depth, and ¼-in. diameter, 30-in. depth. The operator looks down the center of the light beam into the hole. The light is made in two forms—a portable model for inspectors, and a bench light for multiple inspection. The bench light is used with a separate transformer and reel. A standard automotive bulb of 21 candlepower is used. The Extractor Corp., Dept. 13, 25743 West 7 Mile Rd., Detroit 19.

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PAINTBRUSH CLEANER

Clamp attachment is designed for use with hand drills and small portable electric drills for spin-cleaning paintbrushes. Type CT has a ¼-in. shank that fits in the chuck of hand and electric drills. Type ST screws on the spindle of electric drills in place of the small chuck, and is tapped for a ⅜-24 thread, but can be provided with threads to fit the spindle of most ¼-in. portable electric drills. Made of a die-cast cup and ring with hardened steel arms and nickel-plate finish, the attachment offers a method of cleaning paintbrushes or salvaging old, hard brushes by means of centrifugal force. Portable Electric Tools, Inc., 255 West 79th St., Chicago 20.

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MAGNETIC PULLEY

Hi-Intensity Model non-electric permanent magnetic pulley is suitable for automatic separation of ferrous materials from products handled on conveyor belt systems in food, mining, chemical, and general industrial fields. Columbia Eng. Svce. Co., 593 Market St., San Francisco.

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SOAP DISPENSER

Liquid soap dispenser Model 12 is made of rust- and corrosion-resistant Monel metal for heavy-duty requirements. Having about 1-qt. capacity, it features a concealed wall fastening that prevents theft; a large hinged tamper-proof filler cap; and an unbreakable "eye" that indicates need for refill. The dispenser can be attached with screws, or with plastic rubber adhesive. Model 47, dispensing liquid soap in lather form, also is available. Bobrick Mfg. Corp., 1839 Blake Ave., Los Angeles 26.

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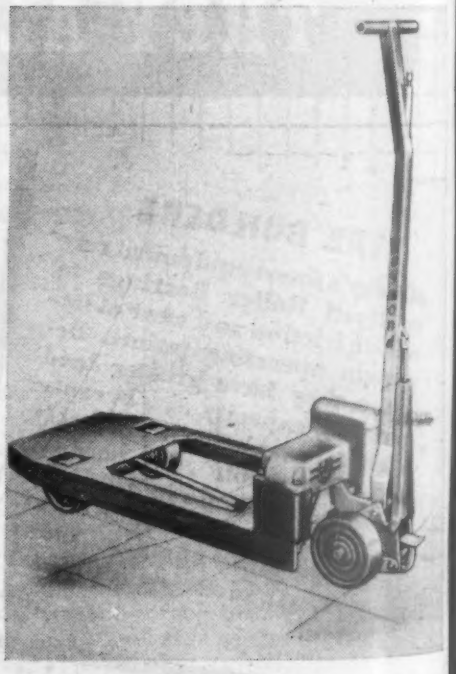
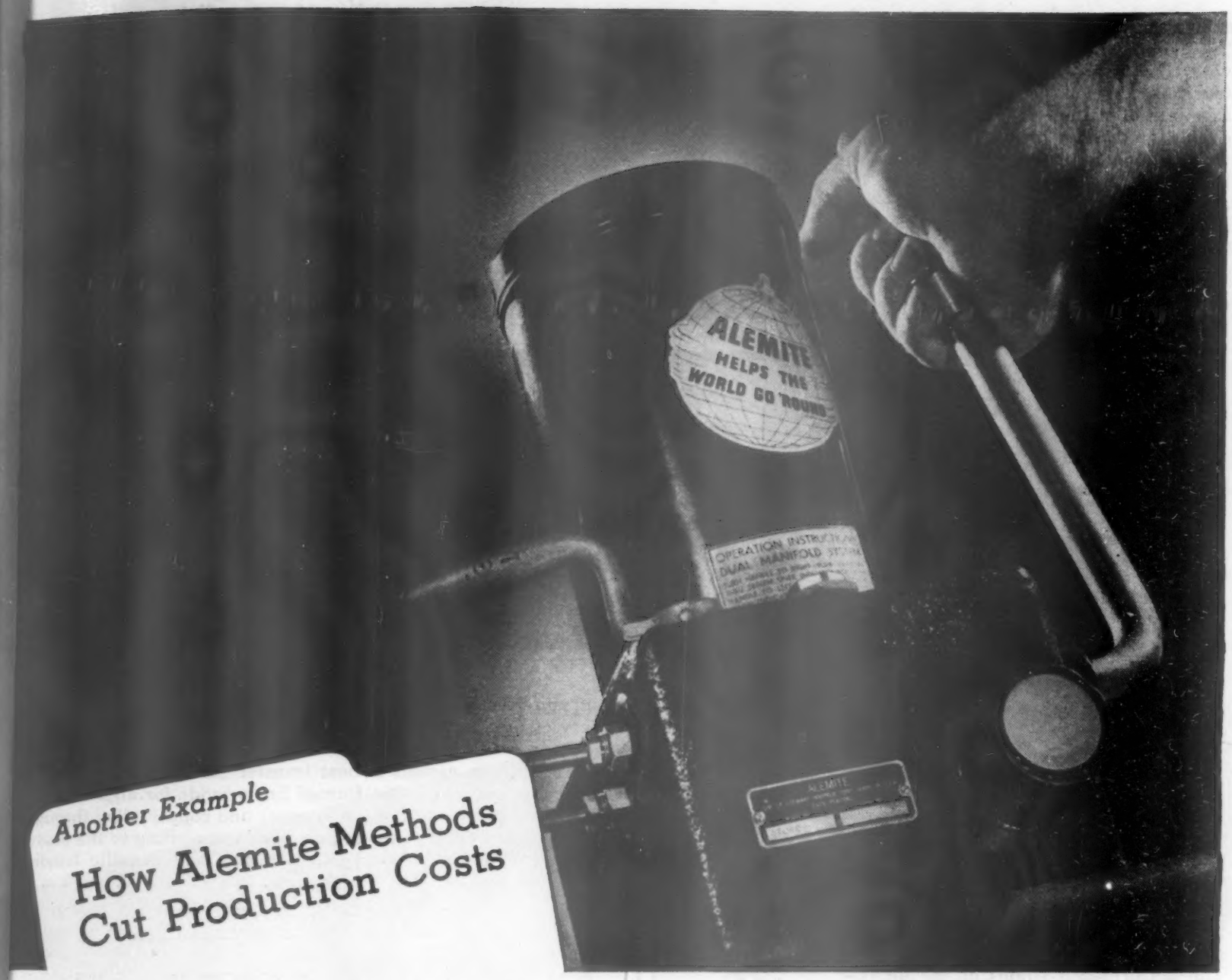


LIFT TRUCK

Lightweight, single-stroke lift truck, for use with skid loads up to 2500 pounds, features increased underclearance for negotiating ramps. Single frame design



Another Example

How Alemite Methods Cut Production Costs

Reduces 182 Lubrication Points to One!

Adds Productive Time to Machines with Faster, More Efficient Handling and Application of Lubricants

Your Lubrication Methods May Be More Antiquated Than You Suspect

If your oilers are still lubricating your machines bearing by bearing, you're losing manhours and cutting productive time. It's time to check up! The Alemite Representative is a *specialist* in modern methods of handling and applying lubricants. A five minute conference with him can easily show you new cost-cutting opportunities. Write to Alemite, 1870 Diversey Parkway, Chicago 14, Illinois.

Whether it's only one hard to reach bearing on a machine or 182 lubrication points on another, you can lubricate all of them perfectly with this modern Alemite Method. With one hand, and a few strokes on a handle, any bearing, no matter how remote, is lubricated perfectly *in seconds* from one safe, central point while the machine keeps on producing!

An Alemite Centralized Lubrication System eliminates "human error," adds more productive time to any machine. It delivers a measured amount of lubricant to each bearing, then signals when the job is completed. Result—no costly bearing failures due to hit-or-miss lubrication.

Just one of many ways that Alemite Methods help industry cut production costs through simplified lubrication procedures. And the Alemite Representative can show you case after case where a time study analysis has proved that his methods reduce maintenance costs. These methods eliminate costly, time-consuming handling of oils and greases . . . slash shutdown time for lubrication . . . completely mechanize lubrication from-barrel-to-bearing . . . save grease . . . keep dirt and moisture out of lubricants. These benefits all add up to lower production costs. Get the complete facts, today.

ALEMITE

Another Product of STEWART WARNER

MODERN LUBRICATION METHODS THAT CUT PRODUCTION COSTS

utilizes heavy-gage formed steel plate. The 8-in.-dia. front wheels are equipped with Timken roller bearings, and the truck operates in a 180-deg. radius. Pushbutton action engages the lifting device, and safety lock on handle prevents injury to operators. Has built-in hydraulic release check. The truck is available in a range of sizes for use with standard skid platforms. Lyon-Raymond Corp., 4462 Madison St., Greene, N. Y.

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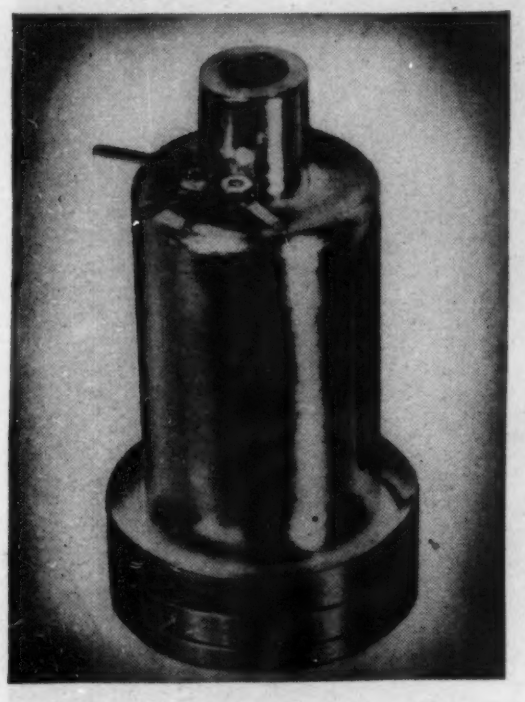

PRESSURE INDICATOR

Small, lightweight Pressure Transducer Type 4713 operates in the range of +20 inches of water. The dome-shaped pressure indicator utilizes the slack-diaphragm principle of measurement. The performance values of the instrument are (1) accuracy—0.4 inch of water, 1 per cent of full range at room temperature; (2) overpressure—limitation of 3 p.s.i.; (3) temperature exposure range from -65 to +70 deg. C. The unit is 3⅞ inches long, 1⅞ inches in diameter, and weighs less than 6 ounces. The potentiometer voltages depend on the resistance range. The unit is suitable for galvanometer-recorders, strain-gages. telemetering links, and for applications where small differential pressures need to be measured. G. M. Giannini & Co., Inc., 285 West Colorado St., Pasadena 1, Calif.

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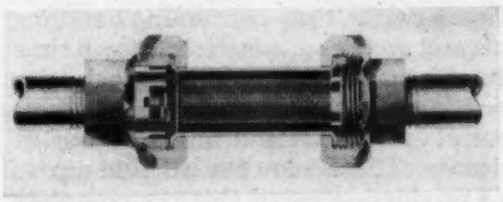
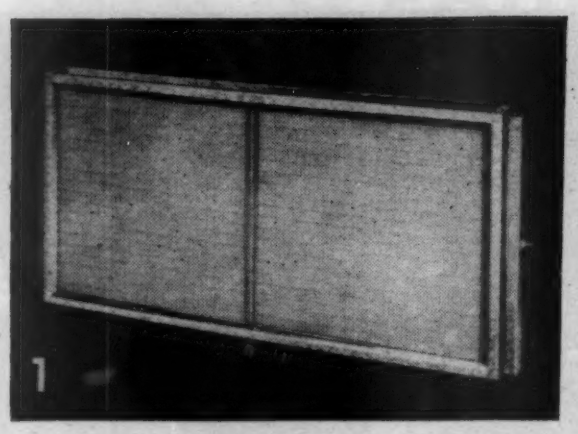
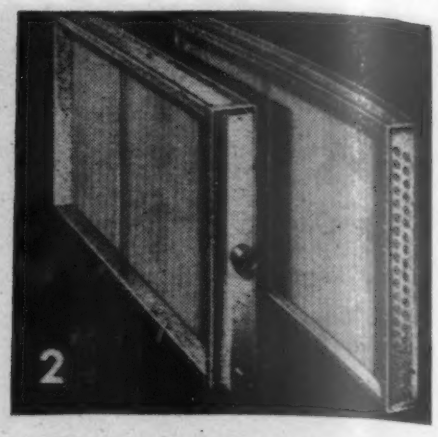
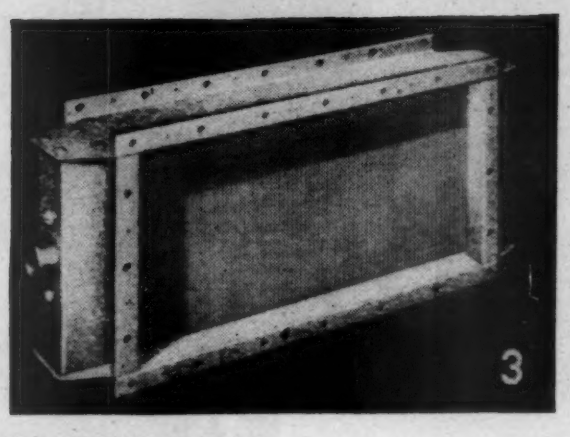


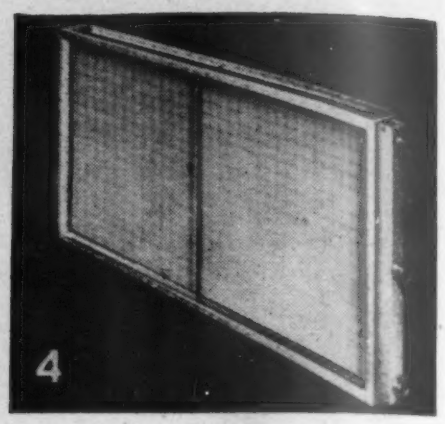
FLOW VALVE

Operating on water, oil steam, and air, the Electroflo valve is self-closing. Said to be quick-acting, anti-hammer, and packless, it permits remote control, automatic control, and time cycle operation. Of bronze construction, it has corrosion-resistant working parts. It combines the power of electricity, flow pressure, and gravity. Hays Mfg. Co., Erie, Pa.



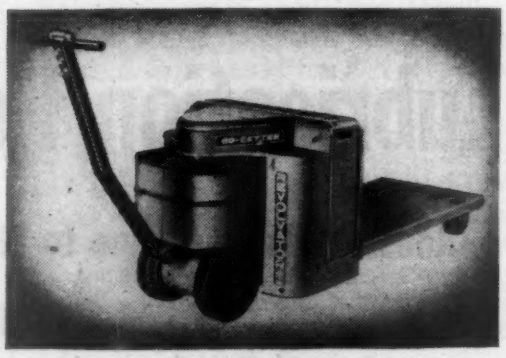






HEATING COILS

Made in standard steam, non-freeze, booster, and hot water types, line of heating coils is announced in a variety of tube and fin combinations and casing sizes. Absence of baffles or shielded headers in casings permits uniform, unrestricted air flow and low friction loss. Because all surface in casings is heat transfer surface, ducts no larger than the coil face area need be employed. Die-formed fins provide for higher heating capacity per square foot of coil face area. Coils are copper and copper-alloy throughout, avoiding electrolysis caused by use of dissimilar metals, according to the manufacturer. Automatic brazing of all steam-carrying passages and metallic bonding of fins to tubes lengthen life. Modine Mfg. Co., Racine, Wis.



POWER LIFT TRUCK

"Walk-along" power lift truck, called Go-Getter, has a single-package hydraulic lift unit on which all adjustments can be made from the outside. The hydraulic or power unit can be removed from the body for maintenance or repairs. The 27½-in. truck comes in 4000- and 6000-lb. capacities, in 7-, 9-, or 11-in. heights, 26½-in. width, and underclearance of 3½ inches. The platform raises 4 inches; 6-in. height available under certain conditions. The truck operates on a 6-cell, 13-plate battery which gives 8-hour operation. Front wheels are 12x3½-in. dual wheels with demountable rubber tires. Features include differential drive which, with the dual front wheels, insures traction on uneven surfaces; delayed action motor control; adjustable dead-man controlled hydraulic braking; and adjustable Timken bearings. Revolvator Co., Tonnele Ave. & 86th St., North Bergen, N. J.

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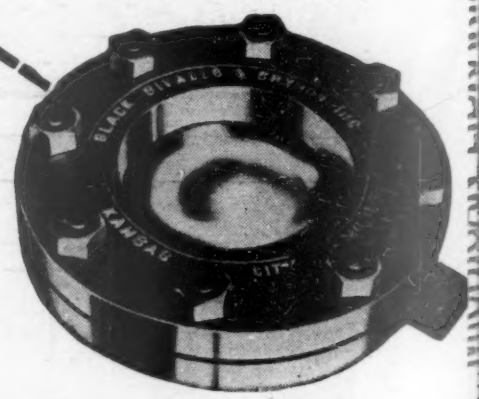
PRODUCTION CONTROL SYSTEM

Production increases averaging better than 10 per cent are claimed to result from a system of production control based on the Model X Chronolog. It records, at pre-selected intervals, when, for what cause, and how long a machine is idle. The tabulated record also indicates the number of units produced (feet or pieces) and the productive time

Stud Book



Thoroughbred horses and pedigreed livestock have nothing on SAFETY HEADS for complete "family" records. Every SAFETY HEAD rupture disc is entered in the SAFETY HEAD Stud Book according to type, size, pressure rating, date of manufacture and delivery and many other factors. Performance records of identical rupture discs sacrificed on the factory test block are also entered. It's quite a library now, for thousands of factories all over the world depend upon SAFETY HEADS for protection against over-pressure. SAFETY HEAD rupture discs burst in tension at predetermined pressures . . . offer a full-throated, pipe-size relief vent. Ideal for either gases or liquids. Replacement discs to exact specifications are easily, quickly provided by checking the records. Write today for latest catalog. Address Special Products Division, Black, Sivalls & Bryson, Inc., Power and Light Building, Kansas City 6, Mo.

EFFICIENCY RELIABILITY

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BLACK, SIVALLS & BRYSON, INC.

KANSAS CITY, MO. OKLAHOMA CITY, OKLA.

required. Provides workers with a record of their own performance, as well as of production lapses over which they have no control. Time cards, job cards, and travel cards are incorporated directly in the instrument. It is smaller than the previous model, with simpler mechanism. Data supplied also cover the simplification of and savings in payroll and cost accounting, production scheduling, and time study standards. The National Acme Co., 170 East 131st., Cleveland 8.

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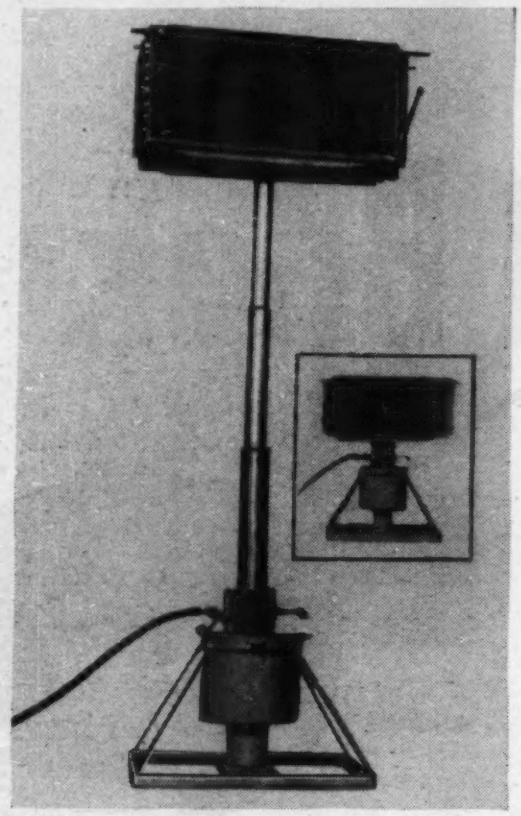

HYDRAULIC HOIST

Air conditioning coils, heavy blower fans, and other equipment can be installed or removed by the Chadlift hydraulic hoist. The table of the hoist is 30 inches from floor level. Air pressure on hydraulic oil raises the ram (with 600-lb. load on the table) to 97½ inches above the floor. Two men can handle the job. The hoist is portable, and comes in three sections. Moves through passageways and doors 20 inches wide. Lifter, Hutchins & Steel, Inc., 7922 Beverly Blvd., Los Angeles 36.

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SEALING LIQUID

Hot-type sealer, for use in insulating refrigerated equipment to keep vapor- and moisture-laden air from the insulation space, is now on the market. Called Sub-Zero Sealer, it is said to be resilient, moisture-and vaporproof, and sufficiently pliable to resist normal impact and torque action. Designed for equipment operating at 0 deg. and lower, it has a melting point of 240 to 260 deg. F., and a penetration at 77 deg. F. of 65 to 75. At minus 10 deg. F., a 1/16-in. film of the sealer on 30-lb. kraft paper can be bent slowly around a 1-in. mandrel without cracking, maker states. It will bond to wood, metal, fiberboard, corkboard, glass, and other materials. Armstrong Cork Co., Lancaster, Pa.

WELDING GENERATOR

Having a welding service range of from 30 to 375 amperes, bare d.c. welding generator Model WG-300 is designed for coupling to a gasoline engine or power take-off. A V-belt pulley arrangement makes exact alignment between power and generator unnecessary, thereby simplifying the building of the welder. Has one control for any desired welding heat in the machine's range. Visa-matic calibration plate facilitates selection of the correct welding current for all types of electrodes. Harnischfeger Corp., Welding Div., 4400 West National Ave., Milwaukee 14.

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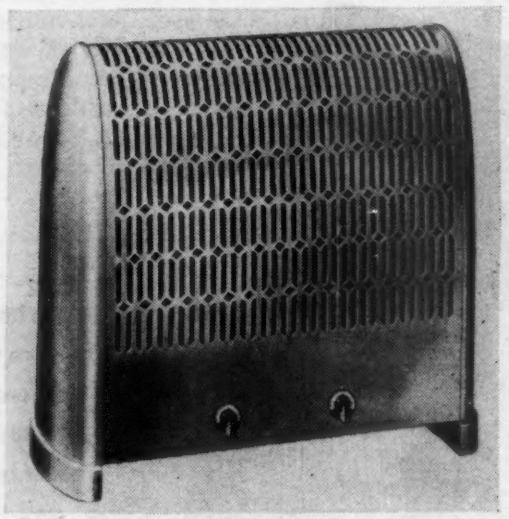

ELECTRIC HEATERS

Floor model electric heater, featuring built-in thermostat with adjustable control, heats by radiation as well as convection. It has a heating element of nickel-chrome supported by a hollow ceramic column. Available in 2000-, 3000-, or 4000-watt capacities, all units are 19 inches high, and operate on 230-volt a.c. A wall-model heater can be recessed in the wall to save space. It is available in 1500-, 2000-, 3000-, and 4000-watt capacities, and operates on 230-volt a.c. Electric Heating Dept., Westinghouse Electric Corp., Emeryville 8, Calif.

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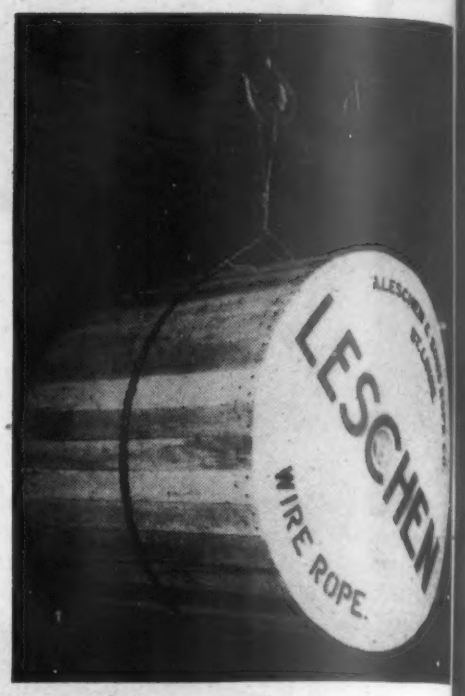
SEPARATE COMPANY

Truck-Man, Inc., formerly a division of Yard-Man, Inc., Jackson, Mich., has incorporated as a separate unit to manufacture the Truck-Man, Model "D," a gasoline-powered hydraulic lift truck, and the Truck-Man Utility, a gasoline-powered platform truck.

EXTERIOR PAINT

Claimed to be non-flammable, fire-resistant, to repel termites, and to prevent dry rot, an exterior paint can be applied over moist surfaces. Has a fish oil base and a solvent said to adapt the paint for seal-coating concrete block and other surfaces of high porosity. Only a slight amount of settling occurs in the cans. The heavy-base aluminum paint is stirred and ready to apply in 20 seconds, maker states. Nu-Oil Paint Co., 2322 Newton St., San Diego, Calif.



WIRE ROPE SLING

Hercules (Red-Strand) sling is made of six parts of wire rope laced together to form a flat, flexible lifting device. It eliminates placing the parts in shear under the pressure of a load, producing support twice as wide as its thickness. Flat, belt-like surface permits distributing load pressure over a greater area than with a round-bodied sling, maker says, resulting in less wear to the sling and less marking of finished surfaces on the load. The loops on the ends are self-supporting without the use of thimbles or servings. Loops are formed by twisting the six rope parts, plus the introduction of a seventh rope, into a round section composed of seven ropes—the seventh acting as a center. The ends of all seven parts are secured under steel sleeves. No splicing is required. A. Leschen & Sons Rope Co., 5909 Kennerly Ave., St. Louis 12, Mo.

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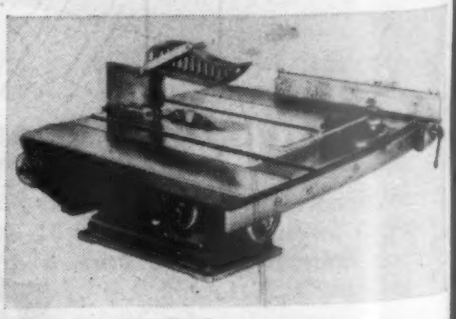

TABLE SAW

Saw, with iron tilting table top, has a base of welded steel, and parts of alum-

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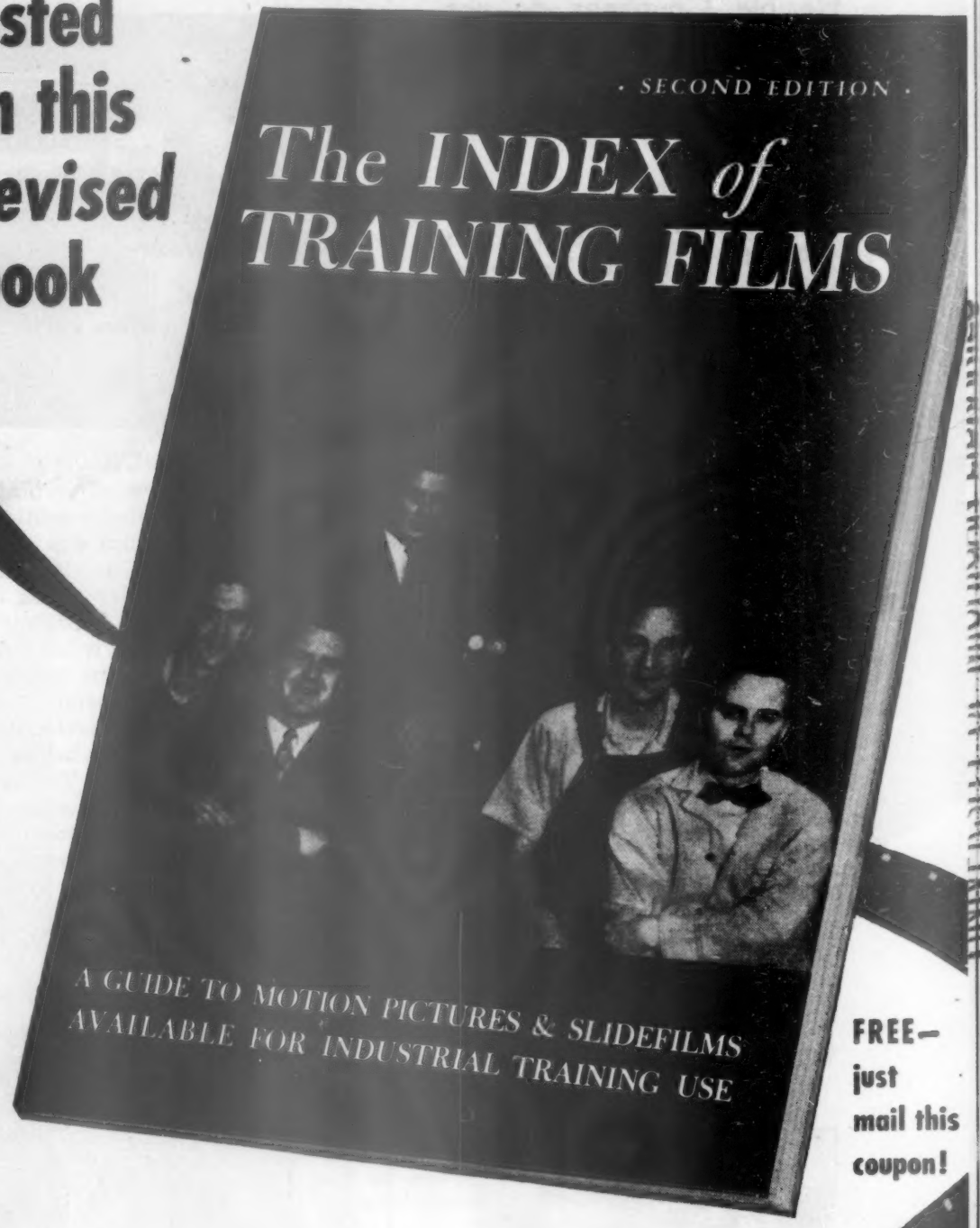
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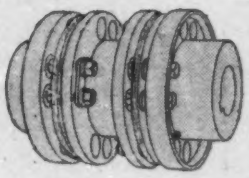
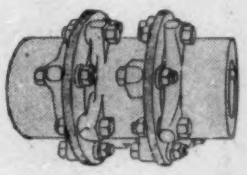
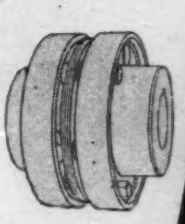
Engineered to stand up on the toughest jobs, Thomas Flexible Couplings do not depend on springs, gears, rubber or grids to drive. All power is transmitted by direct pull.



The standard line of Thomas Couplings meets practically all requirements. But if unusual conditions exist we are equipped to engineer and build special couplings.





BACKLASH FRICTION WEAR and CROSS-PULL are eliminated NO LUBRICATION REQUIRED!

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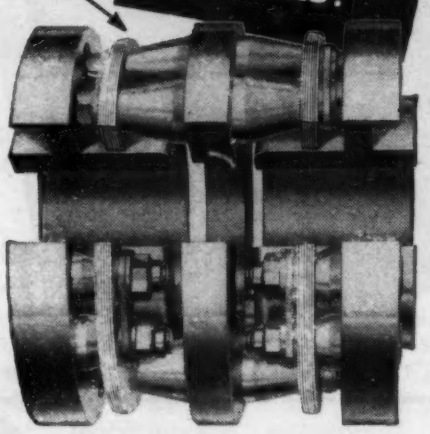

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WARREN, PENNSYLVANIA

inum alloy castings. The ripping fence is a solid steel bar, drilled to permit a wood facing. The saw guard, a soft metal casting, and the safety kick-back guard are mounted on the steel splitter. The motor is mounted on an extension of the arm, which carries the saw arbor. Tilting mechanism is controlled by hand crank, and has positive locking device. Saw blade is also raised and lowered by a crank. The saw table may be equipped with an 8-in. blade and ½-hp. motor, or a 9-in. blade with 1-hp. motor. Walker-Turner Co., Plainfield, N. J.

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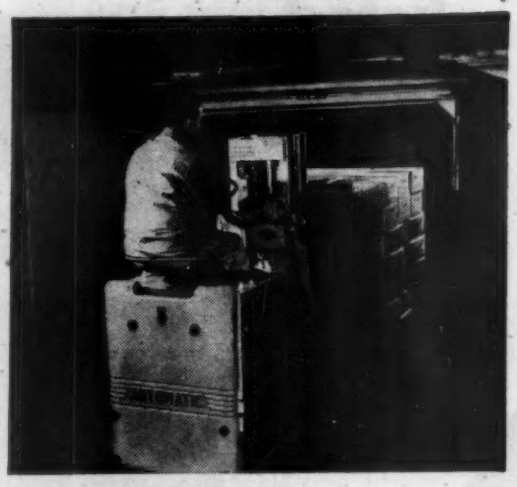

FORK LIFT TRUCK

Engineered for crowded vertical as well as horizontal operating conditions, Skylift Shipper fork truck has dimensions permitting use in refrigerator cars, motor truck and trailer bodies, crowded aisles, and low doors. Handling 2000-lb. and up to 48-in. loads, it has a collapsed height of 68 inches, and 108-in. maximum lift. Forks and uprights are raised independently by separate rams—the forks raise to 58 inches before the uprights begin to extend. The truck incorporates the Newmatic controller, the electric counterpart of automotive automatic gearshift; silicone insulation and lubrication of the electric system; and automotive-type operator controls. Automatic Transportation Co., 149 West 87th St., Chicago 20.

•

BATTERY CHARGER

Motor-driven battery-charging unit is designed for charging 6-cell lead-acid and 10-cell Edison batteries. Starting, charging, and shutdown are performed automatically. The unit meets Industrial Truck Association standards for 8-hour charging periods. The motor-generator set and controls are contained in a cabinet 34x24½x12 inches. On a sloping top are mounted the timer, ammeter, and control switch, for manual or automatic operation. A door in the front opens into a storage cabinet. Beneath the storage space are the m-g set and controls, ventilated by louvers in the sides of the steel enclosure. Lifting eyes are placed on either side of the top. The charger can be used on 220- or 440-, 3-phase, 60-cycle power supply. General Electric Co., Schenectady 5.

•

FLOW CONTROL

Built for use on water, oil, gas, and air, Mesurflo control automatically measures a predetermined amount of flow, regardless of variable pressures. Said to subdue excessive pressure hammer, to reduce operating costs of appliances or equipment, to absorb variable pressure flows automatically, and to permit simple timing mechanism for measured quantities. Consists of bronze couplings, copper tube body, Monel metal strainer, non-corrosive orifice plate, molded rubber diaphragm, and asbestos neoprene gaskets. The Straitflo strainer unit can be removed for cleaning. It performs as a coupling joint. Can also be used for steam. Hays Mfg. Co., Erie, Pa.

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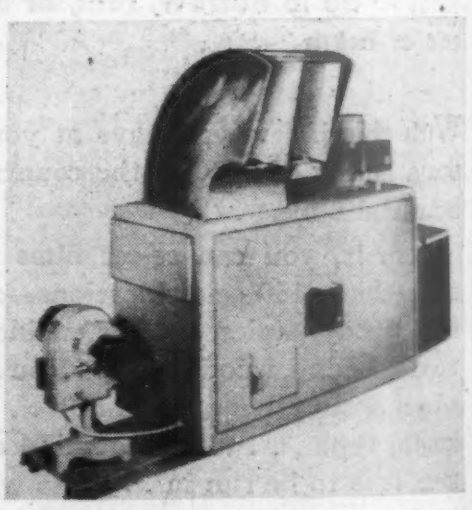
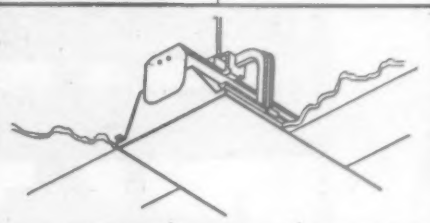
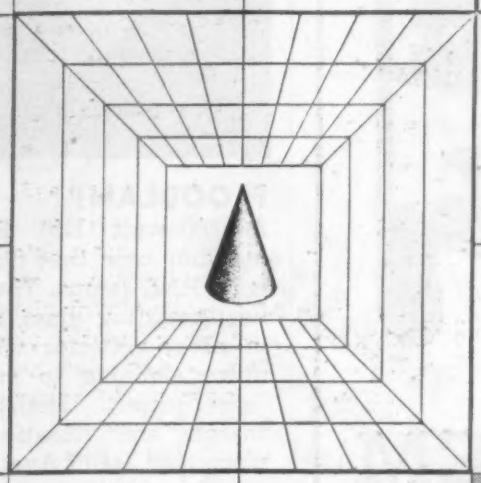


PORTABLE OIL FURNACE

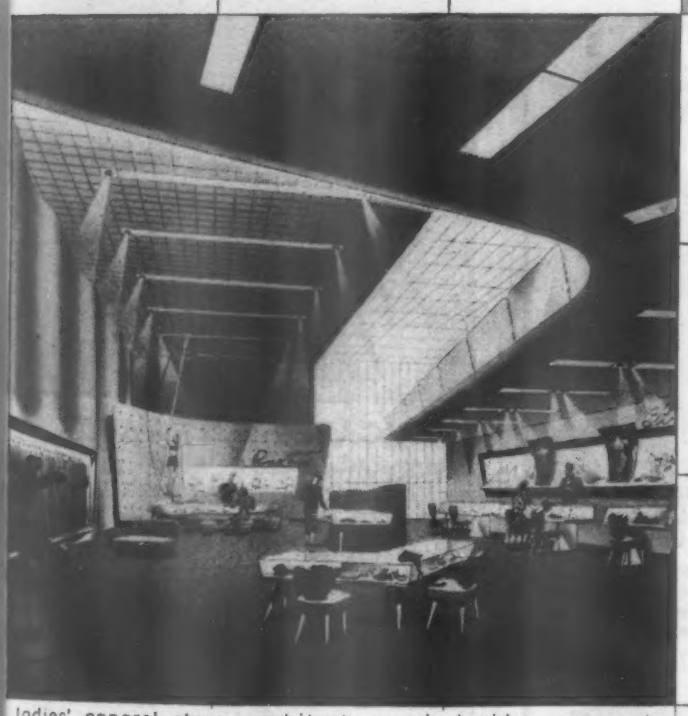
Oil furnace is designed for heating factories, garages, warehouses, and for buildings under construction where it speeds the drying of plaster, and keeps workers warm. Underwriters' Laboratories Approved jet-type gun burner delivers 120,000 B.t.u. per hour at the bonnet. It has a free air delivery of 2800 c.f.m., and burns No. 3 grade oil or lighter. Equipped with Minneapolis-Honeywell combination fan and limit control, and an automatic stack control, automatic humidifier, and large-capacity filtered air intake, it is finished in gray enamel. May be used as a space heater with the plenum mounted on top of the furnace, or can be connected to ductwork. Steel skids permit mounting on a low truck or trailer. Service Metal

light . . . with versatility of installation offering CEILINGS UNLIMITED*





Installation simplified by Miller Ceiling Furring Hanger (patented). Continuous wireway cuts wiring, fitting costs. Units Bonderized, resist rust. Accessible parts—easy service.



ladies' apparel store—architect morris lapidus, new york

Miller Fluorescent Troffer Lighting Systems not only give good light—they make lighting an integral part of the architecture. They can be installed in stores, schools, offices, factories to form ceiling patterns desired . . CEILINGS UNLIMITED.

Miller Lighting Service is all-inclusive. It covers the needs of Planned Lighting.

Miller 50 and 100 Foot Candlers (Continuous Wireway Fluorescent Lighting Systems) have been established as standard for general factory lighting. And Miller incandescent and mercury vapor reflector equipment has broad factory and commercial application.

Miller field engineers and distributors, conveniently located, are at your call

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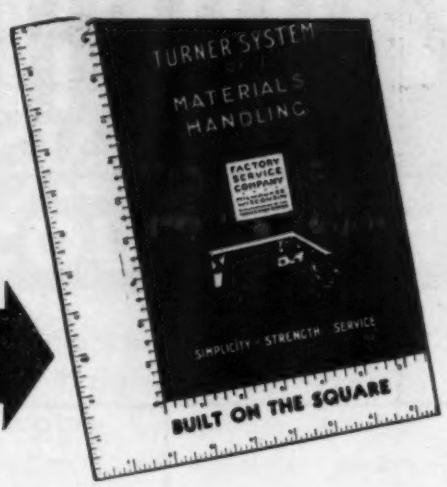
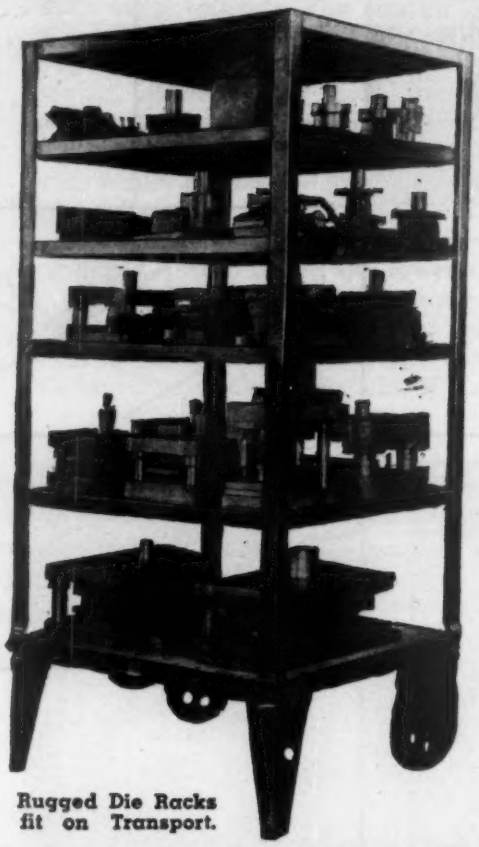




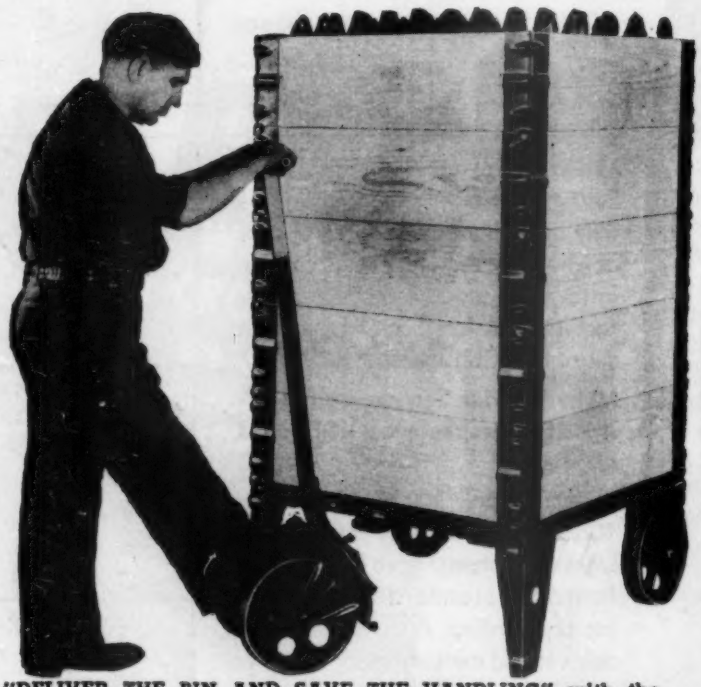
Rugged Die Racks fit on Transport.

This Book Gives You

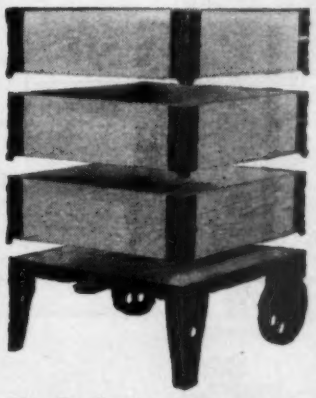
NEW IDEAS

on how to

CUT COSTS With THE TURNER SYSTEM OF MATERIALS HANDLING



With materials handling costs running from 20% to 30% of finished product cost you can probably USE some new ideas — particularly when they are about a system which has saved up to 50% in labor cost, floor space and equipment cost for many firms. Write for your copy of the Turner System Book. It's free.



"DELIVER THE BIN AND SAVE THE HANDLING" with the Transport which is half truck, half platform; saves up to 80% on handling of small parts. Bin Sections, Racks, Trays and Die Tables fit on the Transport which is moved by hand Jimmy, power lift truck, crane or tractor.

Bin Sections are removed as load diminishes, added as load increases. Always the right size bin.

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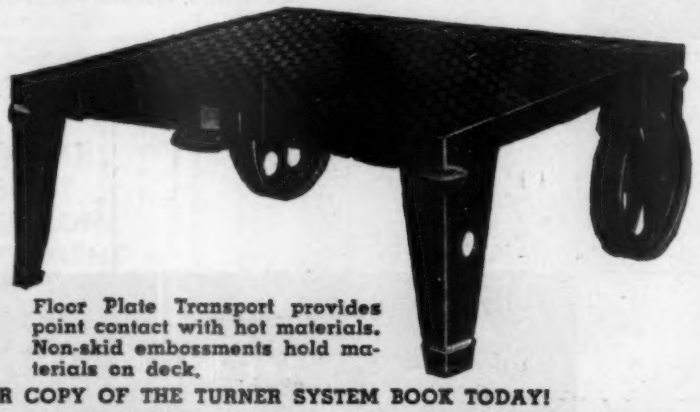
You can determine for yourself how much you can benefit from the TURNER SYSTEM by using an assortment of standard units on a 60 DAYS FREE TRIAL BASIS. Keep them if (in YOUR opinion) they save time, labor and space. Return them if they don't . . . and you pay nothing except low transportation charges.



Floor Plate Transport provides point contact with hot materials. Non-skid embossments hold materials on deck.

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Fabricators, Inc., 2350 West 58th St, Chicago 36.

•

FLOODLAMP

A 200-watt R40 Hi-Floodlamp has medium base that fits fixtures for 150-watt PAR lamps. The lamp is made of heat-resisting glass, and has a sealed-in-silver reflector which does not require cleaning to maintain maximum light output. Resists moisture, sleet, insects, and vibration. Radiant Lamp Corp., 300 Jelliff Ave., Newark, 8, N. J.

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LUBRICATED PLUG VALVE

Hydro-Lube is a plug valve with positive circulation of lubricant. Every time the valve is opened or closed, all contact surfaces are lubricated by hydraulic force. The lubricant ducts are never exposed to the line flow, maker states, thereby reducing the amount of lubricant needed. The valve requires no gasket or stuffing boxes, and is secured by a bushing in the bonnet. This prevents the line flow from passing between the plug and body of the valve. Produced in sizes 1 to 4 inches screwed end, and 1x4-in. flanged end for 175-lb. water or gas pressure. Pittsburgh Valve & Fitting Corp., Barberton, Ohio.

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PRESSURE GAGE SNUBBERS

Pressure gage fluctuations caused by pressure pulsation and vibration are eliminated by snubbers now on the market. Permits the gage to indicate steady average pressures, accurate changes in pressure, and to protect the

How to Increase Production

...without adding manpower!

● It is an established fact—proved by companies in every line of business—that Glidden can show you how to increase production without adding manpower. The simple answer is the scientific use of white and colors in Glidden SPRAY-DAY-LITE, according to a *Sight Perfection* painting plan which Glidden experts will design especially for your plant.

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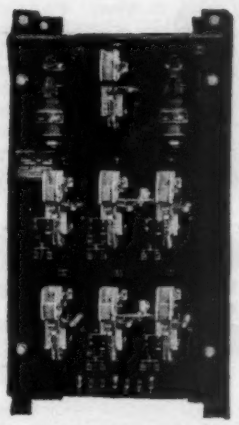
Many Cranes Can Be Controlled to Advantage from the Floor

THIS EC&M Control for **floor-operated** cranes has all the advantages of the well known EC&M Control for **cab-operated** cranes. A single pendant master-station, with two Push Buttons for each motion, makes possible the control of all crane movements. Individual rope-operated Master Switches can be had if desired.

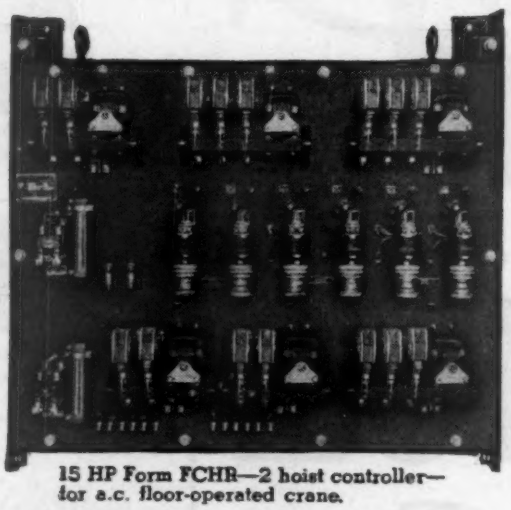
Among the advantages of this standardized line of controllers are (1) accurate inching, (2) compact mounting, and (3) minimum collector-bar requirements. They can be conveniently installed along the crane girders or mounted on the trolley.

Resistors are carefully proportioned for low-torque hoisting of light loads and also provide smooth acceleration for bridge and trolley.

Send for Bulletins 922 (D.C.) and 931 (A.C.) which illustrate and completely describe these units.



Form FCR Controller for trolley or bridge motion —for direct current floor-operated cranes.



15 HP Form FCHR—2 hoist controller—for a.c. floor-operated crane.

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79th STREET • CLEVELAND 4, OHIO

indicator mechanism against undue shock and wear. Porous stainless steel filter disk provides a relatively large filter surface which prevents clog-up in pressure gage service. Filter disks are available for air, oil, water, mercury, and other uses. Design facilitates installation of the snubber in any pressure line for instrument protection, for clarification of small quantities of fluids, as a metering device, and as a protective medium for preventing mercury losses from manometers when they are temporarily overranged. Maximum differential pressure rating of the standard types is 500 p.s.i. Snubbers for use up to 5000 p.s.i. differential can be supplied. Equipoise Controls, Inc., 100 Stevens Ave., Mt. Vernon, N. Y.

•

NUT SETTER

Lightweight portable Speed-o-Matic electric impact nut setter is torqueless—will not twist in the operator's hands when nut becomes tightened, maker says. Drives nut or bolt 1750 r.p.m. at free speed. At point of resistance, impact unit automatically delivers 3000 impact blows per minute. The unit is reversible for removing bolts or nuts. Equipped with 25-ft. rubber-covered cord and plug with ground wire, it operates on any 110-volt, 60-cycle a.c. or d.c. circuit. Has over-all length of 12½ inches, and weighs 13½ pounds. Capacity is up to ¾-in bolts and nuts. Made of Silman steel forgings, and equipped with precision ball and roller bearings, the impact unit can be removed for servicing. Illinois Gage & Mfg. Corp., 4639 West Washington Blvd., Chicago 44.

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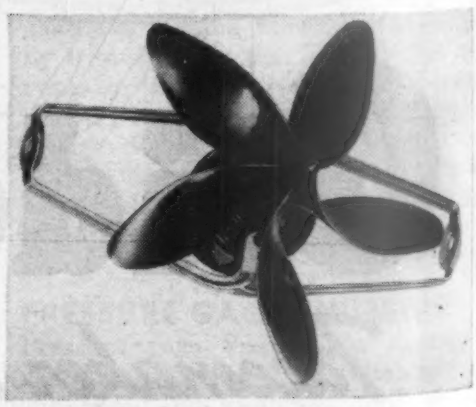

AIR CIRCULATOR

Ventilating unit has propeller blade

Grandma knew all about combustion . . .

CITIES SERVICE

"A CLEAN LAMP burns brightly," that was enough for Grandma. She knew how to get the best performance out of a lamp even if she couldn't explain combustion in her own words.

She knew it had something important to do with cleanliness. "Keep it clean," she would say, "And you'll get the best results. It's as simple as apple pie."

Cleanliness is still the watchword of efficient combustion but the problems of "soot" (combustion residue) in today's high powered internal combustion engines are not as simple as apple pie. Today residual materials *must be* removed by arduous hand cleaning operations or by specially *developed solvents.*

Two such solvents are Cities Service Cisco Pep and Cities Service Cisco Solvent. These two products, developed in the laboratories of Cities Service, are daily saving costs in fuel, reducing maintenance expense and improving the efficiency of countless varieties of internal combustion engines.

Cisco Pep, designed for lubricating the upper cylinder area of engines and freeing valves and rings, also leaves a protective lubricant film on the cleansed surface. Cisco Solvent working on the crankcase zone removes and flushes away harmful sludge, "carbon" or abrasive material.

For further information, or a free demonstration on your equipment by a Cities Service combustion specialist *(in the Cities Service marketing territory East of the Rockies)* write Cities Service Oil Company, Sixty Wall Tower, Room 55, New York 5, N. Y.

CITIES SERVICE OIL COMPANY

NEW YORK • CHICAGO

In the South: ARKANSAS FUEL OIL COMPANY

She SEES it better — she MAKES it better

This operator *knows* that her work will pass inspection. With the aid of a Spencer *Stereoscopic* Shop Microscope she sees smaller details and controls her operation more accurately. The result is less scrap; lowered costs; increased profits.

Designed to meet critical wartime requirements, the Spencer Shop Microscope offers manufacturers new possibilities for quality control at every point—inspection of raw materials, toolmaking, tool inspection during operation, fine machining, and final inspection. Equipped with or without standard base, it is adaptable and can be permanently mounted to your equipment. Choice of optics offers magnifications from 9X to 54X.

For further information write Dept. C156.

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- ★ PRECISION GRINDING
- ★ HAND BROACHING
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- ★ MANY OTHER TOOL-MAKING, FABRICATING, AND INSPECTION PROBLEMS

American Optical
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Scientific Instrument Division
Buffalo 15, New York

Manufacturers of the SPENCER *Scientific Instruments*

molded in one piece of bakelite under 10,500-p.s.i. pressure. Statically and dynamically balanced, according to the manufacturer, the design of the blade and the acoustical characteristics of bakelite eliminate noise and vibration. The propeller blade with setscrew is available also for other equipment requiring air transfer, as well as for double wall ventilation, intake and exhaust assemblies, vehicle ventilators, and hot and cold air ducts. Equipped with standard 110-volt a.c. motor, the air circulator is available also for d.c. and in other voltages. Roto-Beam, 1755 North Keeler Ave., Chicago 39.

•

MAGNET CRANE

One-man, single-engined, self-propelled magnet crane handles iron and steel scrap and ferrous foundry products. Designated Model 22A, the crane has hydraulic steering, an 8-ft. wheel base, and a 22-ft. turning radius. It accommodates 29- or 36-in. electromagnets powered by 3- or 5-kw. generators. The machine is equipped with a Rud-O-Matic magnet tagline reel, and has oversized drums and clutches which are said to provide more precise control at all boom angles for piling, loading, and unloading. The crane moves, lifts, booms, and swings simultaneously or independently, traveling on four dual sets of standard pneumatic tires. Can be converted to a utility crane, clamshell, dragline, shovel, or trench hoe. Wayne Crane Div., American Steel Dredge Co., Inc., Fort Wayne, Ind.

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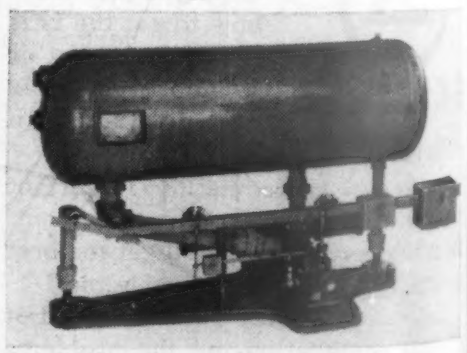

CONDENSATE RETURN SYSTEM

Individual traps on steam-operated equipment and shop lines are eliminated by a condensate return system. Provides constant flow of steam and rapid return to the boiler of high temperature condensate. The system is also adaptable to

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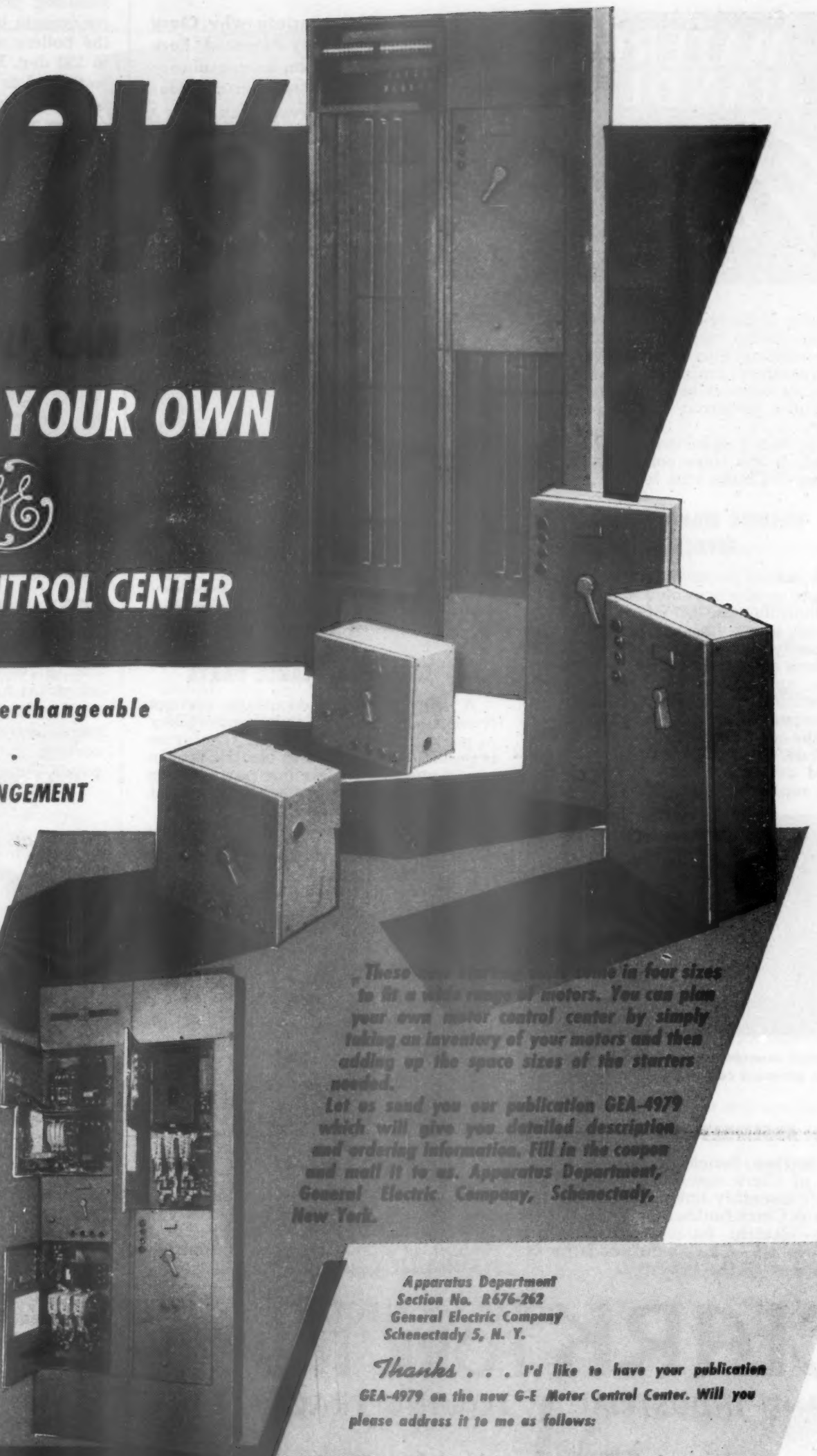
MOTOR CONTROL CENTER



Self-enclosed interchangeable units give you . . .

MORE COMPACT ARRANGEMENT

REDUCED MAINTENANCE

GREATER FLEXIBILITY

These [illegible] come in four sizes to fit a wide range of motors. You can plan your own motor control center by simply taking an inventory of your motors and then adding up the space sizes of the starters needed.

Let us send you our publication GEA-4979 which will give you detailed description and ordering information. Fill in the coupon and mail it to us. Apparatus Department, General Electric Company, Schenectady, New York.

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General Electric Company
Schenectady 5, N. Y.

Thanks . . . I'd like to have your publication GEA-4979 on the new G-E Motor Control Center. Will you please address it to me as follows:

Name _____

Address _____

City and State _____

GENERAL ELECTRIC

MATERIAL HANDLING News

You'll appreciate why Clark Electric Battery-Powered Fork Trucks enjoy an extraordinary leadership when you consider these basic advantages:

1. **Clark manufactures its own major units**
2. **Clark enjoys the benefit of assembly line production**
3. **Clark provides maximum interchangeability of parts**

Among industrial executives who *know operating costs* of electric fork trucks—taking into consideration initial investment, maintenance cost and operating cost—Clark electric fork trucks are preferred by a generous margin.

These men's opinions may be summarized in the terse comment of one of them—"Clarks cost less!"

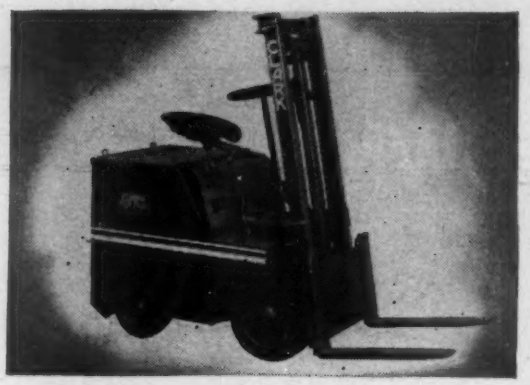
1. VOLUME MANUFACTURE EFFECTS BIG SAVINGS

It is a fact scarcely in need of emphasis to production men that the volume manufacture of Clark machines achieves many important economies. Practically all the major units in Clark machines are produced in Clark's own plants, and on a mass scale—axles, transmissions, wheels, frames and smaller units. All these units must meet the exacting standards established for Clark Products. All possess that rugged excellence that has built the Clark reputation for fine engineering.

Economical assembly saves dollars for customers. Here electrical control gets final inspection.

2. ASSEMBLY-LINE ECONOMIES

A further benefit passed along to users of Clark machines derives from Clark's assembly-line production. Inasmuch as Clark builds both types of fork truck—electric battery-powered and gas-powered—Clark's output is by far the largest in the industry.

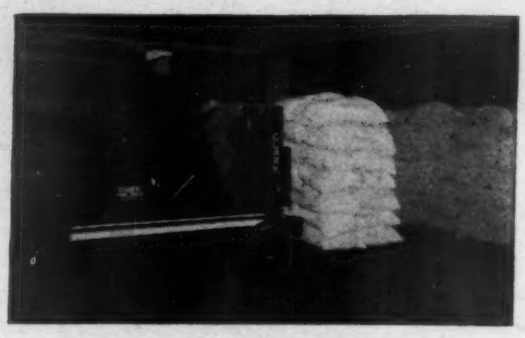


Here is electric battery power in fast, maneuverable form — instantly applicable to countless routine assignments.

3. INTERCHANGEABLE PARTS

A third potent advantage springs from the maximum interchangeability of parts perfected by Clark. Insofar as is possible, parts used in electric trucks are identical with similar parts of gas powered trucks—a source of important savings to Clark users.

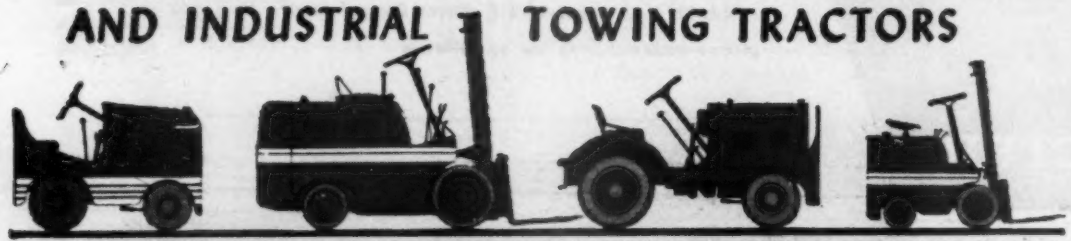
The fact that "Clark builds both" is worthy of repetition, and you realize why. Clark's recommendations are unbiased. You get wholly objective coun-



How to cut handling costs "to the bone"—in one easy picture-lesson.

sel concerning your operations and the types of machines that will serve you most efficiently and economically. Here, indeed, is a good recommendation!—CONSULT CLARK.

CLARK GAS AND ELECTRIC POWERED FORK TRUCKS AND INDUSTRIAL TOWING TRACTORS



CLARK EQUIPMENT COMPANY, TRUCTRACTOR DIVISION, BATTLE CREEK 12, MICH.
REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

handling process liquids. Accumulates condensate by gravity and returns it to the boilers at temperatures ranging up to 350 deg. F. Manufacturer states that water fed to the boiler through the system is de-aerated by liberation of free oxygen and non-condensable gases detrimental to metal under heat and pressure. The systems are available for steam pressures up to 250 pounds in a range of sizes for boilers from 10 horsepower up. No pumps are required. W. M. Acker Organization, 3167 Fulton Rd., Cleveland.

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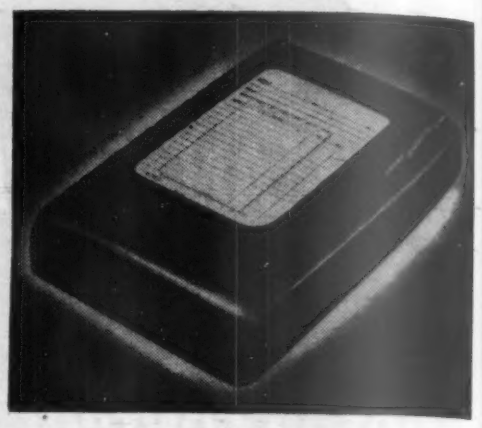

PORTABLE REGISTER

Made of light gage steel, portable autographic register can be used as a desk unit, or carried around the plant. It is adaptable for 2 to 5 copies, and holds up to 75 sets of forms. Has a file compartment, uses roll carbon, and has no sharp corners. A starter is used to eject the paper. American Register Co., 564 East

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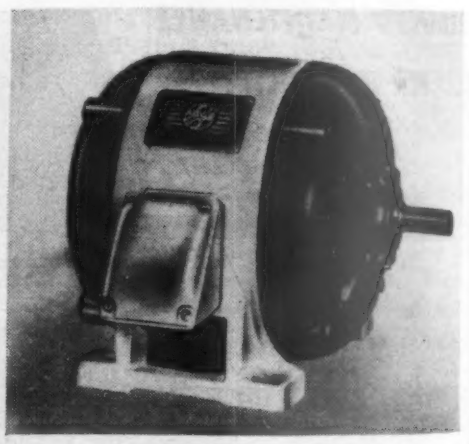


GENERAL-PURPOSE MOTORS

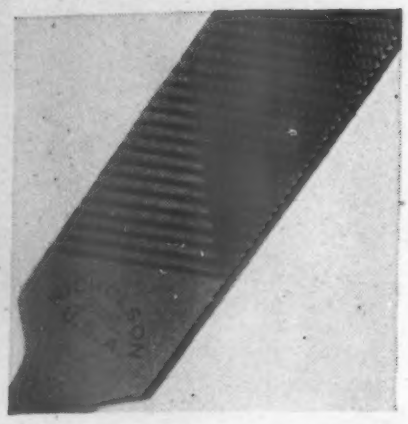
Three general-purpose electric motors, called Permamotors, include fractional-hp., integral-hp. single-phase and integral-hp. polyphase types. The fractional-hp. motors, capacitor-start, single-phase type, are available in 56 and 66 frames with NEMA mounting dimensions. They feature squirrel-cage rotors with positive-acting switches, and bronze sleeve bearings with large wool lubrication reservoirs. Pre-lubricated, sealed-type, ball-bearing fractional-hp. motors also are available. The integral-hp. motors, in 1- to 5-hp. sizes, and frames 203, 204, 224, and 225, have starting capacitors in the starting windings, but are essentially squirrel cage in design. Capacitors are cut out by enclosed voltage relay when motor reaches a predetermined speed. The motors run either clockwise or counterclockwise. The

Subject: FILES FOR ALUMINUM

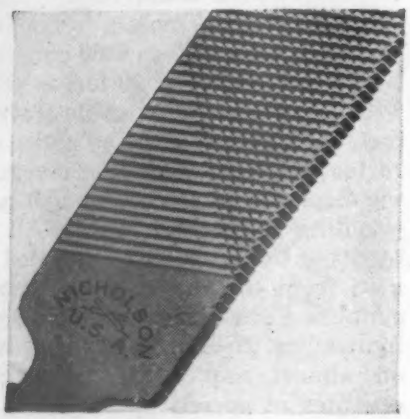
"KNOW YOUR FILES and CUT COSTS"

It's the cost of the workman's time that counts in filing operations. This is one of a series of advertisements on special-purpose files. Save it for shop and purchasing reference.

Prepared by Nicholson File Co.



"Type A" Aluminum File



Flat Bastard File

Filing Aluminum

WHY ALUMINUM REQUIRES A SPECIAL FILE. Aluminum is a soft, ductile, malleable metal and any cutting tool used on it has a tendency to build up chips before it. This is likely to dull the tool. The difficulty in filing soft aluminum with a regular purpose file is that the teeth are soon clogged unless very light pressure is used.

CONSTRUCTION OF ALUMINUM FILE. After much study and practical testing, Nicholson has produced the "Type A" Aluminum File which is specially designed for filing aluminum and aluminum alloy castings. This file has a fine overcut and a deep upcut. The fine overcut produces on the upcut a succession of small scallops which break up the filings and enable the file to clear itself of chips. The open-throat construction also tends to prevent clogging of the file. The light overcut reduces "chatter" by preventing the teeth taking too large bites.

USE OF ALUMINUM FILE. Nicholson and Black Diamond "Type A" Aluminum Files are designed to cut aluminum rapidly and without clogging, but to leave a somewhat better finish than the coarser special files for aluminum. They should be used on work where quick removal of stock is more important than finish; however, by filing with a shearing action toward the left a good finish can easily be made.

In some cases, such as with harder aluminum or aluminum alloy castings, regular Flat Bastard Files are often satisfactory; but wherever these have a tendency to clog, the special-purpose "Type A" Aluminum File should be used.

Nicholson and Black Diamond "Type A" Aluminum Files are available through your industrial supply house. They come in Flat and Half Round shapes, 6″ to 14″ in length, and all in one degree of coarseness.

Nicholson makes special-purpose files for Brass, Lead, Aluminum, Stainless Steel, Foundry Castings, Die Castings, Die Making, Lathe Filing, Curved and Shear Tooth Filing—and Swiss Pattern Files of all shapes and sizes.

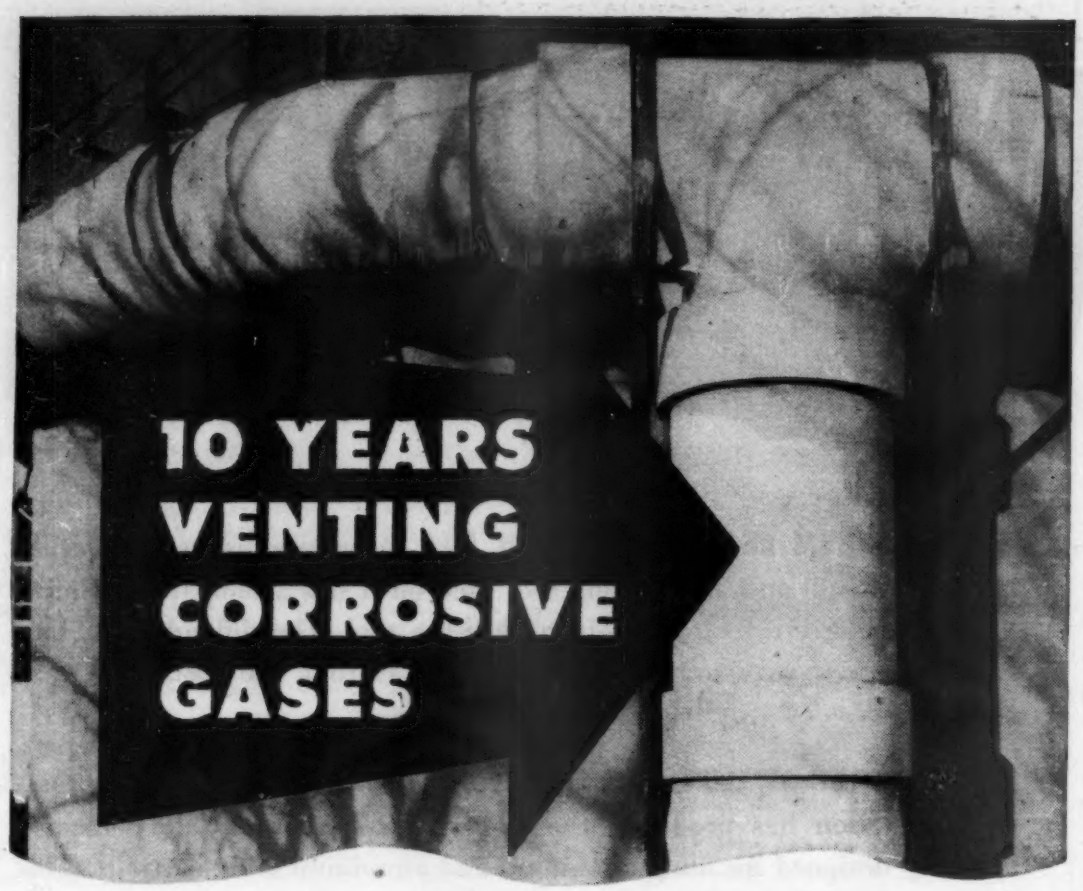
FREE BOOK—*"FILE FILOSOPHY."*

NICHOLSON U.S.A. **NICHOLSON FILE CO., 27 Acorn St., Providence 1, Rhode Island**

(In Canada, Port Hope, Ont.)

BLACK DIAMOND TRADE MARK

NICHOLSON FILES FOR EVERY PURPOSE



. . . and this duct of

TRANSITE INDUSTRIAL VENT PIPE

has never required maintenance

TEN YEARS AGO, the operators of the Dunellen-Plainfield (N.J.) joint sewage disposal plant faced a serious maintenance problem. Every eight months, the duct carrying corrosive gases from the sludge-drying chambers had to be replaced. Then this plant installed the Transite Duct shown above . . . and in 10 years not one cent has been spent for maintenance.

Strong and durable, Transite Industrial Vent Pipe successfully resists many of the corrosive gases, vapors and fumes met in industrial operations . . . provides effective and economical venting service in a wide variety of industries.

You can use this asbestos-cement pipe outdoors or indoors, for it is rustproof and weather resistant . . . needs no painting. Light in weight and readily assembled, it comes in 19 sizes from 2" to 36" in diameter . . . with a full line of Transite fittings to assure corrosion-resistance throughout the system.

Data Sheet DS-336 gives full details and is free on request. Address Johns-Manville, Box 290, New York 16, New York.

JOHNS-MANVILLE JM PRODUCTS

Typical industries in which Transite Industrial Vent Pipe is used

Aircraft	Dairy	Gas	Petroleum	Shipbuilding
Automobile	Drug	Glass	Potash	Shoe
Baking	Electrical	Laboratory	Pulp & Paper	Smelting
Bleaching	Explosive	Laundry	Quarrying	Soap
Boiler Works	Farm Machinery	Leather	Railroad	Soft Drink
Brewing	Food	Meat Packing	Rayon	Sugar Refining
Canning	Foundry	Metal	Refrigeration	Textile
Ceramic	Furnace	Mining	Rubber	Tool
Chemical	Furniture	Paint	Sewage Works	Water Works

Johns-Manville
TRANSITE Industrial Vent **PIPE**

polyphase, squirrel-cage, inducti motor (illustrated), in frames 203-3 has a large shaft of SAE 1035 hot-roll steel. Interchangeable double-shield ball bearings permit shaft extensi from either or both ends of motor. T rotor has ventilating fans cast to en rings. A. O. Smith Electrical Mfg. C 5701 Smithway, Los Angeles 22.

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HYDRAULIC CRANE

Lugger Crane, a mobile hydraulic unit, lifts and carries up to 6000 pounds. Vertical boom travel of 10 feet is provided with a corresponding cable travel of 1 feet. Maximum clearance under hook i 18 feet 6-inches. Sidewise movement o the boom is limited for stability when handling maximum loads. All movements of the crane are controlled by one man from the driver's seat, through a simplified system of precision Daybrook hydraulics. The half-track chassis works on almost any kind of terrain, and operates at speeds up to 40 m.p.h. The chassis is also equipped to perform towing and pushing operations. Day-Smith Hydraulic Crane Corp., Camp Hill, Pa.

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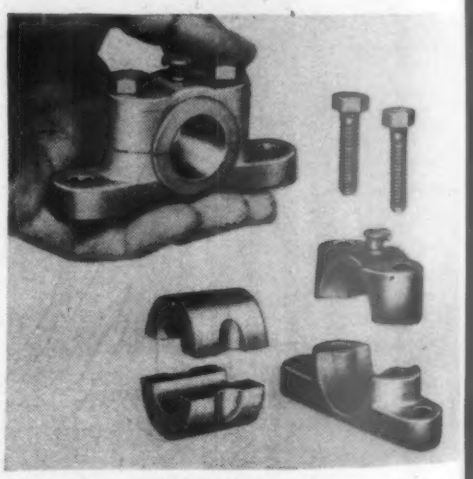


PILLOW BLOCKS AND ACCESSORIES

Line of Shopcraft power accessories includes die-cast pillow flanges, collars, and V-belt sheaves, as well as circular blocks, and saw and grinding wheel mandrels. Larger and heavier, they include a split cap bolted with 5/16-in. capscrews. A spring-top oil cup is fitted

LIGHT THE VITAL SEEING ZONE *with* LOCALITES

"FIRST FOR SEEING"

The primary function of industrial lighting is to illuminate the worker's task so that he can see quickly, accurately and comfortably all details of his operation. The better his seeing tool — the higher is his efficiency. Only with localized lighting units can the proper quantity of illumination be focused on the immediate work area of each operation according to the seeing requirements of the worker for his particular task. In combination with a proper proportion of general overhead lighting, to avoid too wide a contrast between the illumination of the immediate work area and the surrounding area, the result is Balanced Lighting — planned lighting at its BEST.

• *Improves* PRODUCTION —CUTS COST

MODEL 3470-P-172

Used for large presses, milling and boring machines. Also assembly and inspection benches. Overall length 45½". Three joint adjustable. Circular base for 3-screw mounting.

In excess of 200 footcandles.

$6.11 COMPLETE *(Net Industrial Price)*

MODEL 32-H-174

Recommended for small machine tools, lathes, punch presses, etc. Overall length 23¼". Two joint adjustable. Flat oblong base for screw mounting.

In excess of 175 footcandles.

$4.31 COMPLETE *(Net Industrial Price)*

MODEL 3267-C-172

Used for machine tools, assembly, inspection, and instrument repair work. Overall length 32¾". Three joint adjustable. Circular base for 3-screw mounting.

In excess of 200 footcandles.

$5.89 COMPLETE *(Net Industrial Price)*

FOSTORIA LIGHTING EQUIPMENT AVAILABLE THROUGH SELECTED WHOLESALERS FROM COAST TO COAST

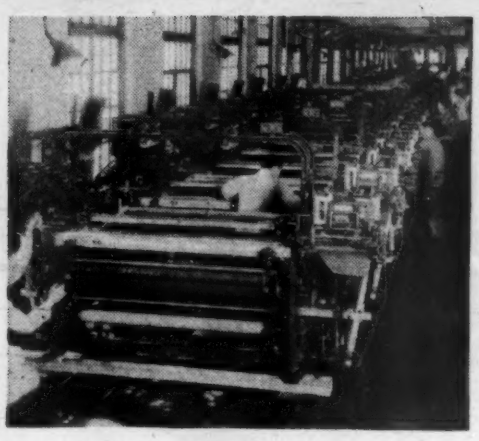
- Write for folder on "How to Plan Your Lighting" and complete selection of Localite models.

THE FOSTORIA PRESSED STEEL CORP.

FOSTORIA, OHIO, U. S. A.

In Canada:
Amalgamated Elec. Corp. and all Northern Electric Branches

BALANCED LIGHTING fostoria
GENERALITES for Overall Lighting • LOCALITES for Light ON the Job
Trade Mark Reg. U. S. Pat. Off.



Low Tool Cost aids high volume, low cost Textile Loom Production

Mr. O. V. Payne, Works Manager, Crompton & Knowles Loom Works, Worcester, Mass. highlights cost reducing McCaskey Tool Control in this way:

"We have used McCaskey Methods in our main tool crib and three of our subsidiary cribs since 1941. The manufacture of over 100,000 textile loom components has benefitted by speedier tool service and lower tool costs.

"Specifically McCaskey has: (1) Speeded up tool crib operation, (2) tied responsibility for specific tools to specific employees, (3) location of all tools on the floor can be speedily ascertained, (4) cut our tool inventory by disclosing dead and infrequently used tools, (5) cut excessive inventory of many active items, and (6) provided us with the medium for detailed analysis of tool loss, breakage, use and performance . . . all contributing to low tool costs."

Let us have a qualified representative explain how McCaskey Control will save from the beginning in your plant . . . or send you proof of McCaskey savings in several other well-known plants.

McCaskey INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • TOOLS • COSTS • PAYROLL

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCaskey Systems Ltd., Galt, Canada — The McCaskey Register Co., Watford, England

to the bearing cup, providing an oil reservoir for bearing lubrication. Split bearings are cast separately and are furnished as replaceable inserts in both Zemac metal and bronze. Uniform in size, the pillow blocks have bearing inserts in bore diameters of ½, ⅝, ¾, and 1 inch. Steel mandrel assemblies are available in two types—threaded at each end in right- and left-hand threads, suitable for double wheel applications; and threaded at one end only. Mandrels are available in ½-, ⅝-, ¾-, and ⅞-in. diameters. Over-all lengths are 12, 14, and 16 inches. O. F. DeCastro & Assocs., 674 West Washington Blvd., Los Angeles.

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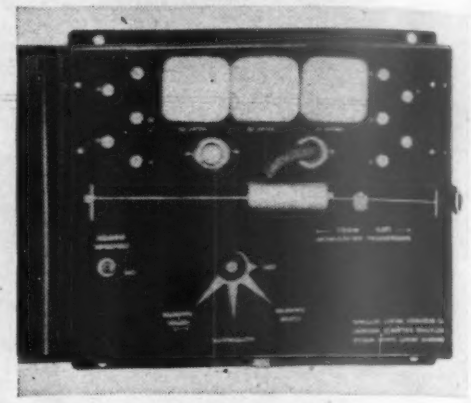

DAMPER CONTROL

Electric remote damper control Model DCR-A provides, in one cabinet, all the elements for automatic control of stack draft. Features claimed are protection to boiler plant equipment; reduction of smoke, soot, and fly ash; and increased safety of boiler operation. A differential adjustment may be set to the desired sensitivity by the turn of an accessible control knob. A selector switch gives manual control when needed, and an emergency cutout switch permits cutting out all control and returning to manual operation. An application plug adapts the control to stoker, oil-, or gas-fired boilers. Three plug-in relays provide time delay. Safeguards place damper in full open position in case of burner failure, and shut off burners when selector switch is moved from automatic position. Cleveland Fuel Equipment Co., 1836 Euclid Ave., Cleveland 15.

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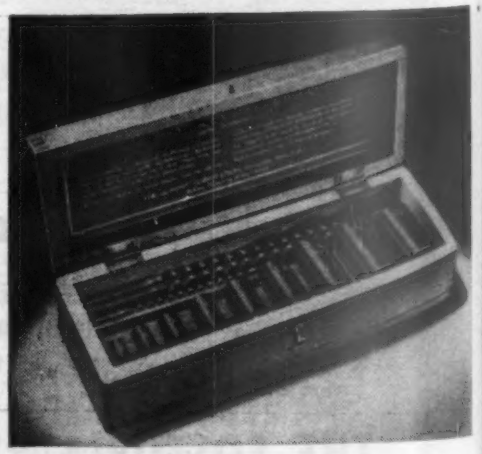
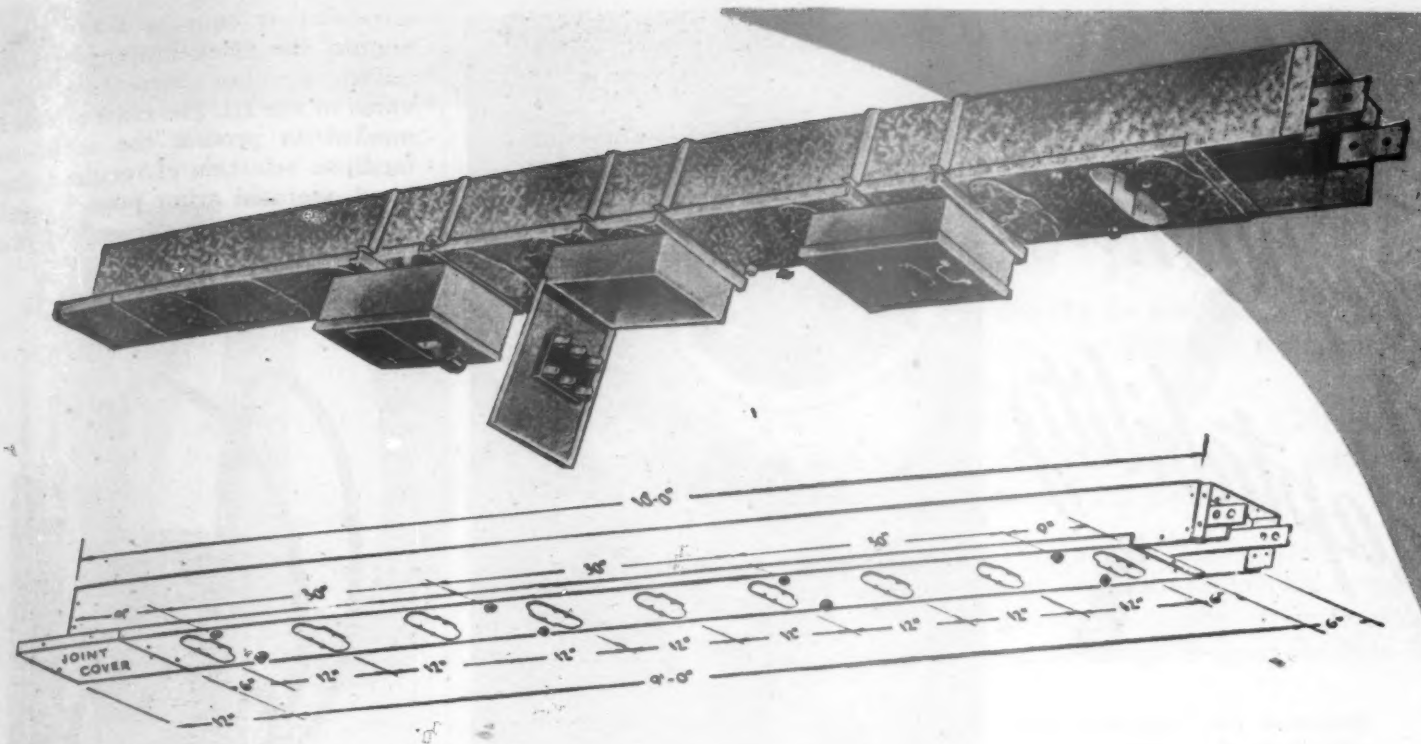


KEYWAY BROACH KIT

"Minute Man" keyway broach kit is for hand-cutting keyways of any standard width and any depth in gears, milling cutters, pulley hubs, collars, couplings, and other parts requiring keyways. The



Plugin FA BUSDUCT

Provides PLUGIN OUTLETS Every Foot of the Way

More and more industrial plants are replacing their costly, complex and outmoded electrical systems with the new, economical and flexible PLUGIN FA BUSDUCT system.

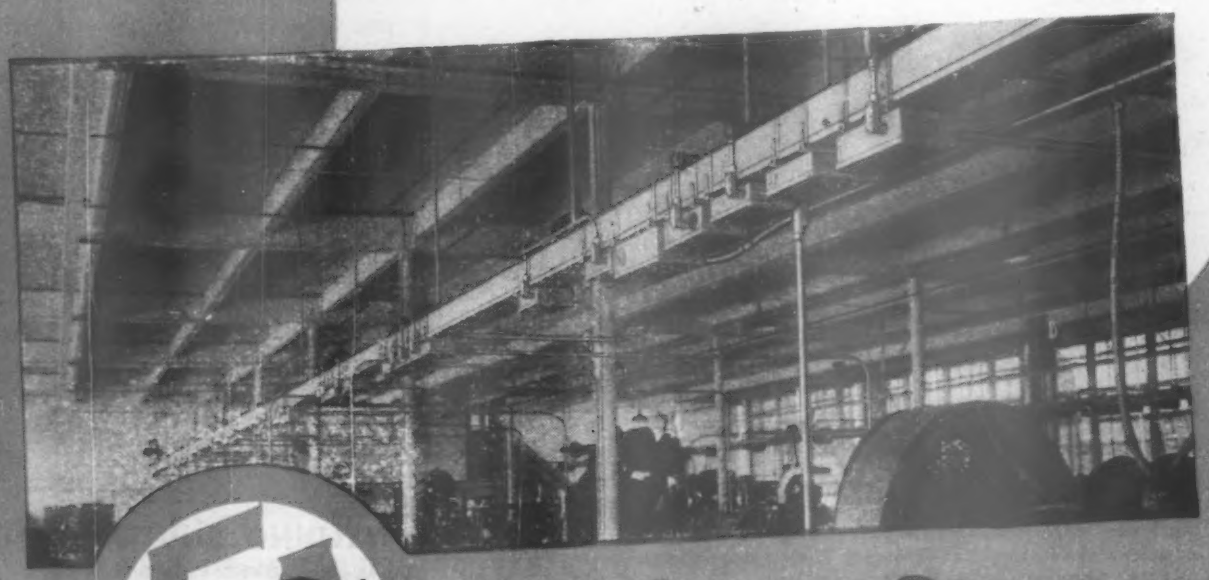
By providing convenient Plugin outlets every foot of the way, Plugin FA Busduct makes it possible to move and relocate machinery at will . . . eliminates costly temporary connections and long, expensive lead-ins . . . greatly reduces maintenance costs . . . and saves thousands of man hours normally lost each year.

You'll find this economical, flexible system of power and light distribution helps speed production by providing a Plugin outlet within convenient radius of your needs . . . always.

Available in standard 10-foot lengths in capacities from 250 to 1000 amps. for 575 volts AC or less, with multiple outlets for any of the following Plugin Units:

FA SHUTLBRAK—for quick make and break, heavy-duty operations; FA KLAMPSWITCHFUZ—splendid for disconnect service; and FA CIRCUIT BREAKER—for automatic, thermal-magnetic overload protection.

For further details, write for our new Bulletin No. 701.



FA TRADE MARK

Frank Adam Electric Co.

ST. LOUIS 3, MISSOURI

Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKMETER

Exceptional Adaptability

Measuring the dimensions and orientations of punched holes in radio tube micas, to tolerances of .0001", on a Jones & Lamson Optical Comparator. Photographs courtesy Hytron Radio & Electronics Corp.

This is a typical example of the adaptability of Jones & Lamson Optical Comparators to unusual inspection needs. These Comparators are designed to cover an almost unlimited range of inspection work—they provide a means of inspection that is accurate, rapid and economical. Costly gages can be dispensed with, costly time saved and quality improved.

Many components and products formerly inspected by slow, tedious methods that retarded production and drained profits, are now inspected in a matter of seconds or minutes on Jones & Lamson Comparators, with consequent savings all along the line.

Our engineers are inspection specialists, their knowledge of holding fixtures, handling methods and suitable Comparator equipment, qualify them to study your inspection problems, no matter how unusual, and make recommendations that will improve your profit picture. They have for others.

Write for descriptive literature. Or, better still, ask for one of our inspection engineers to call.

JONES & LAMSON MACHINE COMPANY
6 Clinton St., Springfield, Vermont, U.S.A.

Manufacturer of: Universal Turret Lathes · Fay Automatic Lathes · Automatic Double-End Milling and Centering Machines · Automatic Thread Grinders · Optical Comparators · Automatic Opening Threading Dies and Chasers · Ground Thread Flat Rolling Dies

Jones & Lamson
OPTICAL COMPARATORS

operation is said to take about one minute. Broaches, bushings, shims, and keyway stock of different sizes are provided in the kit. The cases are compartmented to protect the tools, and to facilitate selection of required sizes. A hand-operated arbor press is available. The du Mont Corp., Greenfield, Mass.

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VOLTAGE TESTER

Testing continuity of circuits (a.c. or d.c.), 110 to 550 volts a.c., 110 to 600 volts d.c., testing unit also indicates grounded side of line, grounded side of motor or appliance, excessive leakage to ground, frequency (25 or 60 cycles), and d.c. polarity. The solenoid indicator and neon test lamp operate independently of each other. Anchored 2-ft. leads are brought out through top of case to facilitate handling and reading. The tester is encased in plastic. Has easy-to-read scale calibrated from 110 to 600 volts. Over-all length is 6 inches. Leads are 2 feet long. Test prod handles are 4 inches long, and the prods are 2 inches long. Unit has carrying case with belt clip. Weighs 8 ounces. Ideal Industries, Inc., 1416 Park Ave., Sycamore, Ill.

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WELDING SHUTOFF VALVE

Quick-shutoff valve is designed to prevent oxygen and acetylene waste in production welding. Called Oxweld V-31, the dual shutoff station valve, when used with the oxyacetylene blowpipe, controls the supply of oxygen and acetylene or other fuel gas. When welding is interrupted, the blowpipe is hung on the hook, and consumption of gas is

YOU

FURNISH THE STEEL

. . . if you can supply us with 12 to 24 gauge sheet steel, we will buy the steel from you and ship pound for pound:

—Lyon standard products—any selection of items in production at regular published prices—see partial list below

—or

—your own assemblies, subassemblies or parts, etc., for your product—to your specifications —in an even wider range of gauges—8 to 30.

LYON

A PARTIAL LIST OF LYON PRODUCTS

- Shelving
- Lockers
- Wood Working Benches
- Economy Locker Racks
- Kitchen Cabinets
- Display Equipment
- Hanging Cabinets
- Welding Benches
- Filing Cabinets
- Cabinet Benches
- Folding Chairs
- Drawing Tables
- Storage Cabinets
- Bench Drawers
- Work Benches
- Drawer Units
- Conveyors
- Shop Boxes
- Bar Racks
- Bin Units
- Tool Stands
- Service Carts
- Hopper Bins
- Parts Cases
- Flat Drawer Files
- Tool Trays
- Desks
- Stools
- Tool Boxes
- Sorting Files
- Ironing Tables

The Makers and Distributors of

CHAMPION

FLUORESCENT and *Incandescent*

LAMPS

For Every Industrial Service

Urge You to Make the Most of

PLANNED LIGHTING

For better products and increased production at lower over-all cost *plan your lighting* before you buy lamps or fixtures.

CHAMPION helps you:

1. By supplying the finest quality, longest lasting lamps that forty-eight years of specialized experience in the manufacture of lamps for industry can produce.

2. By concentrating on low overhead and direct sale through qualified industrial suppliers to assure you minimum lamp and lighting cost.

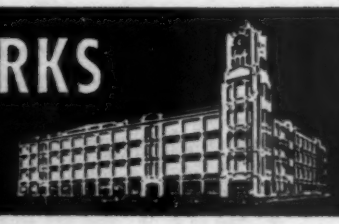
3. By stationing trained lighting experts in industrial centers to furnish prompt, dependable recommendations on all lamp or lighting problems.

Let us mail you a copy of the Champion Maintenance Manual C. It's full of useful hints on how to make the most of *planned lighting.*

CHAMPION LAMP WORKS

Lynn, Massachusetts

A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO



stopped. Valve features a self-sealing packing that operates without leakage, and with little or no servicing. It is suitable for operating pressures up to 100 p.s.i. Adjustable base can be set for either wall or bench mounting. The Linde Air Products Co., unit of Union Carbide & Carbon Corp., 30 East 42nd St., New York 17.

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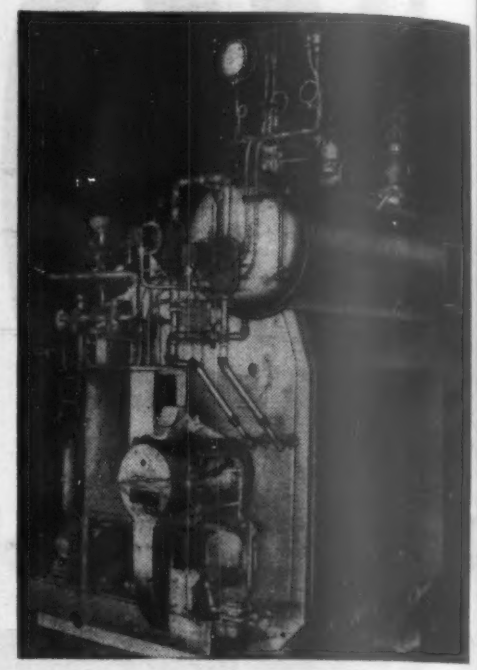

STEAM GENERATOR

Packaged steam generators up to 27,000-lb. per hour range are made for oil and gas-firing. Two series, of low pressure (up to 250-lb.), and high (up to 850-lb.), are available. Combustion controls provide full or semi-automatic operation, as desired, and are integral part of unit. Operation from central control panel requires minimum attention. Foster-Wheeler Corp., 165 Broadway, New York.

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FIRE EXTINGUISHER

Designed to operate under all climatic conditions and in winds and drafts, dry chemical fire extinguisher has 10-lb. capacity. The chemical is ejected under

pressure in a flat stream that separates the flame from the burning material, forming a dense, fire-smothering cloud over a flaming area up to a distance of 18 feet, according to the manufacturer. It is said to create an insulating barrier between the operator and the flame, providing protection from radiant heat. On hot metal surfaces, the chemical forms an insulating film, helping to guard against re-flash. All-Out Mfg. Corp., 2 Park Ave., New York.

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MOTORIZED HAND TRUCK

Having a 1000-lb. capacity for wet or dry materials, and the ability to climb a 20 per cent grade with full load, the Prime Mover has three wheels, is power-operated, and can be equipped with a bucket, or a steel and wood platform deck. A snow plow attachment also is available. Has a 3-hp. aircooled engine, and operates for 8 hours on 3 gallons of fuel. Transmission, clutch, and gears are enclosed; no belts or chains are used to transmit power from the engine. The bucket has a capacity of 10 cubic feet, and with the addition of sideboards, up to 18 cubic feet for lighter materials. The platform and the bucket dump automatically, and then return to a level, locked position. The truck turns in its own radius, passes through ordinary doorways, and operates in close quarters. Speed is a fast walking pace. Bell Aircraft Corp., P.O. Box 1, Buffalo 5.

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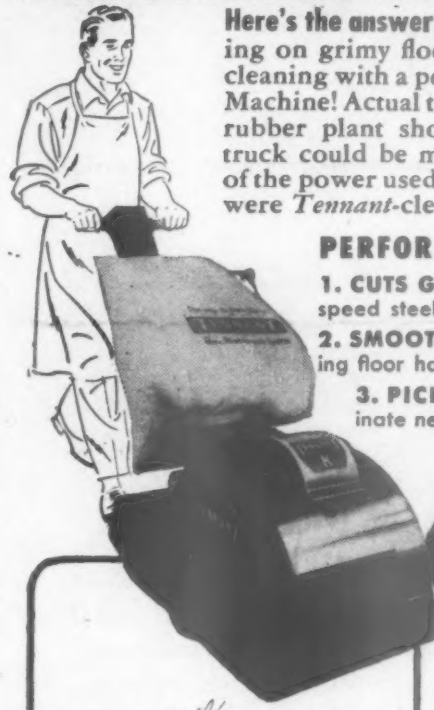
TEMPERATURE CONTROLLERS

Available with or without pyrometers, stepless input temperature controllers are suitable for electric and gas furnaces, ovens, pots, and similar applications.



Here's the answer to slow, bumpy trucking on grimy floors—fast, mechanized cleaning with a powerful *Tennant* Floor Machine! Actual tests in a typical Akron rubber plant showed that a 1430-lb. truck could be moved with only 50% of the power used before . . . after floors were *Tennant*-cleaned.

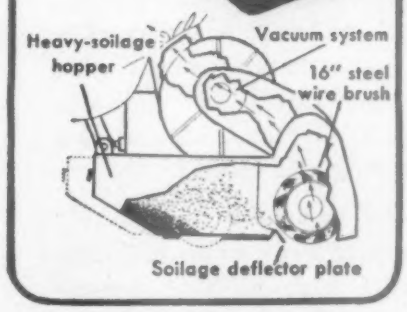
PERFORMS 3 OPERATIONS

1. CUTS GRIME LOOSE with high-speed steel wire brush or Revo-tool.
2. SMOOTHS, LEVELS surface, leaving floor hard, dry, ready for traffic.
3. PICKS UP SOILAGE to eliminate need for sweep-up.

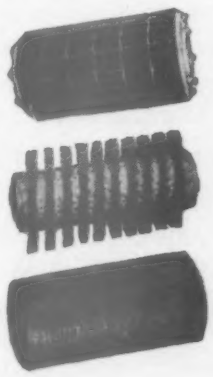
Fast, mechanical cleaning removes ALL the grime; leaves smooth, easy-trucking surface.

TENNANT
Industrial Floor Machine

● Requires only 1 man ● Eliminates hand scraping ● No need for chemicals, soap or water ● Cleans close to walls, machines ● Doesn't interfere with plant operation.



Picks up as it goes! **Drum accessory throws heavy soilage into built-in pan; vacuum system controls light dirt and dust. LEAVES FLOOR CLEAN.**



REVO-TOOL—A 16" drum-mounted accessory for heavy-industry floors. Has hundreds of alloy-steel cutters. Excellent for dried paint, metal chips, tar. Powerful and guaranteed effective.

STEEL WIRE BRUSH—Does a perfect job in removing grease and rubbery grime from wood block and concrete floors. Smooth-working, non-clogging.

STEEL WOOL ROLL—Ideal for fast dry cleaning of stripwood floors. *Eliminates scrubbing.* A favorite of textile mills and similar plants.

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G. H. TENNANT CO., 2554 N. 2nd St., Minneapolis 11, Minn.

Please send us, without obligation, illustrated Bulletins on Tennant Industrial Floor Machines.

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Company_____

Address_____

City_____ Zone_____ State_____

Ask a Tennant Representative to inspect your floors. No obligation

The way to finer floors
TENNANT
Floor Maintenance System

OFFICES IN PRINCIPAL CITIES

Regardless of the nature of the gas or liquid to be handled, you can choose a TITEFLEX all-metal flexible tubing of the required corrosion resistance. For TITEFLEX tubing is furnished with innercore made of brass, monel, inconel, nickel-clad, or stainless steel to assure satisfactory performance over a wide temperature range and under practically all conditions where corrosion is encountered. TITEFLEX also offers a wide choice of materials for braiding and fittings.

Remember, too, that TITEFLEX is constructed entirely of metal—with no packing to wear away or disintegrate. Play safe, specify TITEFLEX ALL-METAL flexible tubing for replacements and for new installations. Competent engineering service available on request.

If you do not already have a copy of the Titeflex tubing catalog No. 113, we will be pleased to send you one. Write today.

Titeflex, Inc. 505 Frelinghuysen Ave., Newark 5, N. J.

Exclusive Manufacturers of Titeflex high quality products for more than 30 years

Sales Offices { CHICAGO CLEVELAND DETROIT PHILADELPHIA LOS ANGELES BOSTON SAN FRANCISCO TORONTO

Model IF 4, equipped with a pyrome calibrated to 2000 deg. F., can be suppli for other temperature ranges. Whe pyrometer accuracy is not required, where there is a pyrometer already the installation, Model IF 2 is furnish Called Infitrol, all models operate 115-volt a.c., but 220-volt units may obtained. With plug-in arrangeme the controllers are suitable for curre up to 15 amperes. For any higher curre permanent styles with knockouts a suggested. K. H. Huppert Co., 68 Cottage Grove Ave., Chicago 37.

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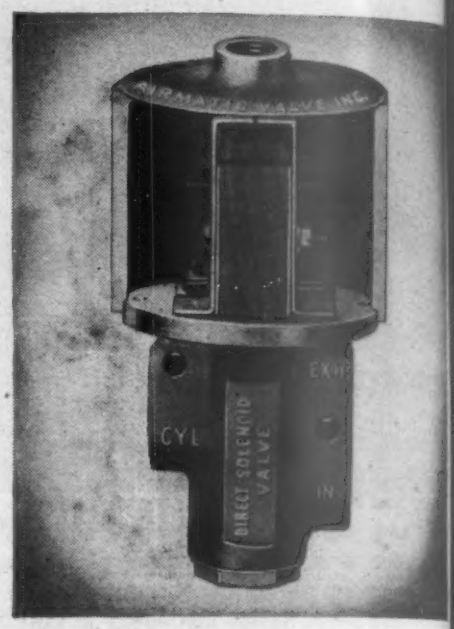


SOLENOID VALVE

Non-corrosive, full-capacity, 3-way direct-operating solenoid-controlled valve, Model DS-3, is announced. Eliminates pilots, levers, distributors, and other types of indirect control. Can be mounted in any position, and operated continuously without harm to the valve or solenoid, maker says. The solenoid is rated 1.42 amperes in rush, 0.22 amperes holding at 110 volts, 60 cycles. Furnished in ¼-, ⅜-, ½-, and ¾-in. pipe sizes. Airmatic Valve, Inc., 1643 East 40th St., Cleveland.

•

AIRLINE HEATER

Heating the air provided to outside workers using air-supplied respirators

the RIGHT *horsepower*

Available in sizes from 1/10 to 100 horsepower.

the RIGHT *shaft speed*

Gear reduction ratios range up to 432 to 1.

and RIGHT *where you want it*

Master Gearmotors, available in millions on millions of combinations of types and ratings, permit you to use a power drive on each job that's just right . . . a power drive that will add greatly to the compactness, appearance, and economy of each of your applications.

Use Master Gearmotors to increase the saleability of your motor-driven products . . . improve the economy, safety, and productivity of your plant equipment. They're the horsesense way to use horsepower.

MASTER GEARMOTORS

THE MASTER ELECTRIC COMPANY · DAYTON 1, OHIO

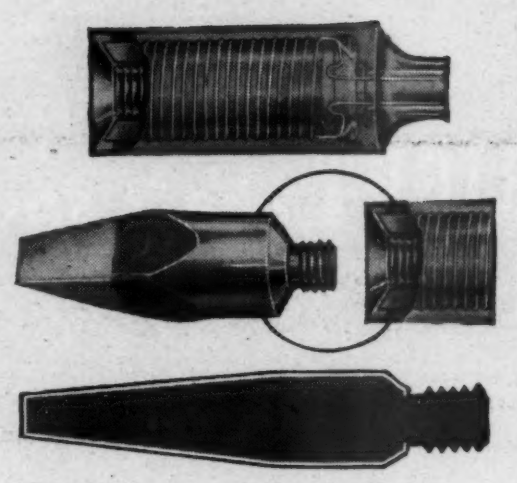
MORE SOLDERING HOURS PER DAY

when you use Stanley Electric Irons with ARMOR CLAD Tips

Get down to work faster . . . Scientific construction of the heating element channels the heat to the tip faster.

More heat where you need it most . . . Valve-seat fit of the tip in the socket assures constant flow of heat right down to the work.

No time out for tip dressing . . . Armor Clad Tips need no filing. Just retinning. Special metal sheath, bonded to a solid copper tip, stops wear, oxidation, pitting and amalgamation of copper with solder. Big



industrial users say Armor Clad Tips (available for leading makes of irons) outlast all-copper tips 3 to 10 times.

Available in both screw and plug tip types . . . all sizes and popular shapes. Write for helpful booklet, "Expert Soldering". Your distributor has a complete stock of Stanley Electric Irons. Stanley Tools, 151 Elm Street, New Britain, Conn.

Screw Tip
No. 380 . . .
315 Watts

Plug Tip
No. 385 . . .
350 Watts

The greatest name in tools

STANLEY

Reg. U.S. Pat. Off.

HARDWARE · HAND TOOLS · ELECTRIC TOOLS

equipment, airline heater assures supply of comfortably warm, thermostat controlled air even in temperatures 30 deg. below zero. Weighing 4 pounds the unit consists of an electric heater, heat exchanger, and thermostat, enclosed in a rubber-covered cylinder inches long, with 2½-in. outside diameter. It is worn clipped to the rear of user's belt. Can be worn as a part of the air hose, providing no interference with the worker's movements. Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh 8.

•

VACUUM CLEANER

All-purpose industrial tank-type cleaner can be used for general vacuum cleaning, dust collecting, and water pick-up. Air filters are enclosed. Removable cloth bag filter collects the dust. Mounted on four 5-in. wheels, it has a low center of gravity, with the motor unit mounted in the bottom. Swivel wheels in front permit the unit to follow the hose, and small width enables the cleaner to move down narrow aisles. A 1⅓-hp. continuous-duty motor provides the power. Construction is of 16-gage steel. A 30-ft. primary cord provides coverage of 2700 square feet. Ideal Industries, Inc., 1448 Park Ave., Sycamore, Ill.

•

RADIATION PYROMETER

Temperatures above 1000 deg. F. are determined by thermo-electric principles with the Pyro radiation pyrometer. The self-contained instrument is direct reading, and requires no outside

More materials move...faster... at less cost this NEW way

The BELL Prime-Mover*

SOMETHING brand new in profit-earning equipment...the BELL *Prime-Mover* keeps all kinds of material moving faster in shops and warehouses, on loading platforms, in yards and wherever else there's work to be done!

A rugged 10 cubic foot, power-driven bucket, the *Prime-Mover* dumps mechanically, climbs 20% grades with full load, turns in its own length, and passes easily through narrow aisles and 32" doorways. For extra utility the bucket lifts off without use of tools, and a platform is locked in place, giving you a half-ton platform carrier for staked or unstaked loads. A blade attachment turns the *Prime-Mover* into a baby bulldozer that doubles as a snow plow.

The *Prime-Mover* is built for dependability in rough service. You can put it in the hands of any workman...it takes only 3 minutes to learn the simple controls. With this machine you get reduced employee fatigue and better morale as valuable by-products of *increased individual productivity*.

For low operating cost, engine, transmission and clutch run in oil, fully enclosed. No belts, no chains. Fuel: 3 gallons for a busy 8-hour day.

Let this *new* carrier eat up those profit-eating jobs!

A PRODUCT OF **BELL** *Aircraft* CORPORATION

SEND COUPON NOW

Bell Aircraft Corporation
P. O. Box 1F-3, Buffalo 5, N. Y.

Please send me engineering data, costs and operating experience on the *Prime-Mover*.
Our business is.....

Name.....

Company.....

Address.....

City, Zone & State.....

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There's no point in monkeying around with makeshift wire rope fasteners, on jobs *where safety comes first.* All over the world, big jobs and small jobs are rigged with genuine CROSBY CLIPS. They're steel, drop-forged, hot dip galvanized. Correct design makes a positive "vise-tight" grip. Complete run of sizes . . . for ⅛ inch to 3 inch wire rope. Distributors everywhere. Made only by AMERICAN HOIST and Derrick Co., St. Paul 1, Minnesota.

Industry uses more

CROSBY CLIPS

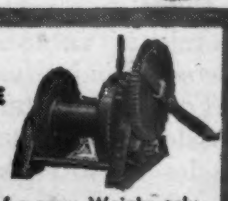
than all other

drop-forged fasteners

For Armored Construction . . . specify
AMERICAN BLOCKS AND SHEAVES

● A complete line of wire rope blocks—all types, all sizes, in capacities from 1½ to 250 tons. Thick steel side plates, heavy pins and axles. Ask for American equipment when ordering.

ONE MAN LIFTS 10,000 LBS. WITH THE AMERICAN HANDIWINCH



● Gives one man the power of a crew. Weighs only 95 lbs. Handles lifting, loading and pulling jobs up to 5 tons. All steel construction. Ask your distributor.

connections, lead wires, batteries, o other accessories. The automatic un requires no skill or previous instructio for use. The instrument is sighted at th object being measured, and the tem perature is indicated on the scale. Th indicator locking device holds th pointer at the reading until a button i pushed to return the indicator to zer position. The steel housing eliminate external magnetic and electric in fluences. Applications include measur ing spot temperatures above 1000 deg. F in furnaces, forgings, fire boxes, kiln and retorts. The Pyrometer Instrume Co., 103 Lafayette St., New York.

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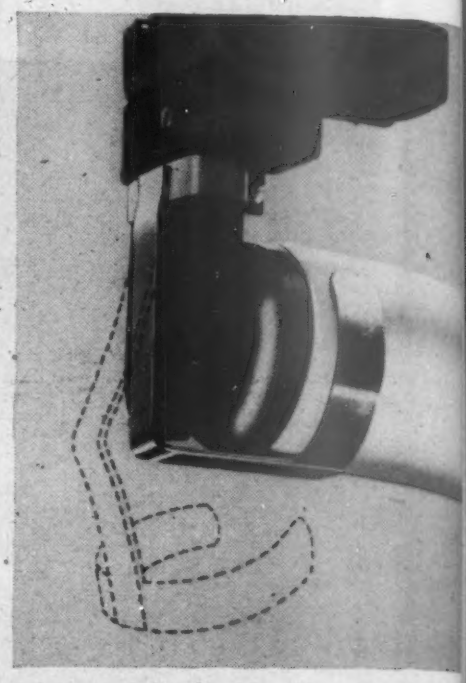

FLUORESCENT TUBE CLIP

Preventing fluorescent tubes from fall ing, the Den-El safety clip is said t secure the tubes regardless of vibration Made of resilient stainless steel, the clip are permanently installed by tightening the nut on a machine screw. The band that holds the tube can be pulled aside when lamps are replaced, and resumes holding position when released. They are made in sizes for 40- and 100-watt tubes. General Scientific Equipment Co., 27th & Huntingdon Sts., Philadelphia 32.

•

AIR EXHAUST

Motor of air exhaust is mounted out of the air stream, and does not require cleaning, according to the manufacturer. Direct-connected to a self-cleaning

New A big-capacity, heavy-duty production unit engineered for safety ... accuracy ... convenience

Delta* 20" Wood-cutting Band Saw

Takes any type of blade in any size up to 1 inch in width. Maximum height under upper guide is 13½"

Now you can enjoy famous Delta quality in a heavy-duty wood-cutting band saw designed to meet the needs of your pattern shop, maintenance shop, shipping department, and other departments where you perform wood-sawing operations.

Delta 20" Band Saw features are among the newest and most advanced in the industry — many of them exclusive with Delta:

- Single-unit welded steel cabinet completely encloses all working parts. Doors provide quick access to wheels and motor.
- Adjustable "three-point mountings" between working parts and welded steel frame help to maintain exact alignment.
- Statically-balanced aluminum wheels are mounted in sealed-for-life ball bearings. Handy adjustable control on upper wheel helps you to maintain proper blade tension for each particular job.
- Wheels are made of aluminum, to reduce flywheel action after motor is shut off.
- Convenient foot brake is provided on lower wheel.
- Motor is mounted in base on pivot bracket which automatically provides correct belt tension.
- Dust chute carries away dust and chips . . . can be attached to dust collector.

These are just a few of the reasons why you can expect creditable performance from the new Delta 20" Wood-cutting Band Saw.

Your nearby Delta distributor can give you the complete story on this new, husky machine. See him soon. Look for his name under "Tools" in the classified section of your telephone directory.

DELTA MANUFACTURING DIVISION
ROCKWELL MANUFACTURING COMPANY
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General Sales Office • 6 NORTH MICHIGAN AVENUE, CHICAGO 2, ILLINOIS

*Trade Mark Reg. U. S. Pat. Off.

20" x 24" table is rigidly supported on two wide-ly-spaced trunnions. Conveniently tilts 45° to right; 12° to left.

Heavily-ribbed table is slotted to accommodate miter gage. It is also adaptable to use of a rip fence, as shown.

Ball-bearing blade guides, above and below table, are fitted with micrometer adjustment.

* Free Bulletin! Gives specifications and detailed description of Delta 20" Wood-cutting Band Saw. There's a copy ready for mailing to you. Request it by coupon below.

TEAR OUT COUPON AND MAIL TODAY!

DELTA MANUFACTURING DIVISION
619C Vienna Ave., Milwaukee 1, Wis.

Send me free copy of Bulletin A-28-3 describing Delta 20" Wood-cutting Band Saw.

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Company.....
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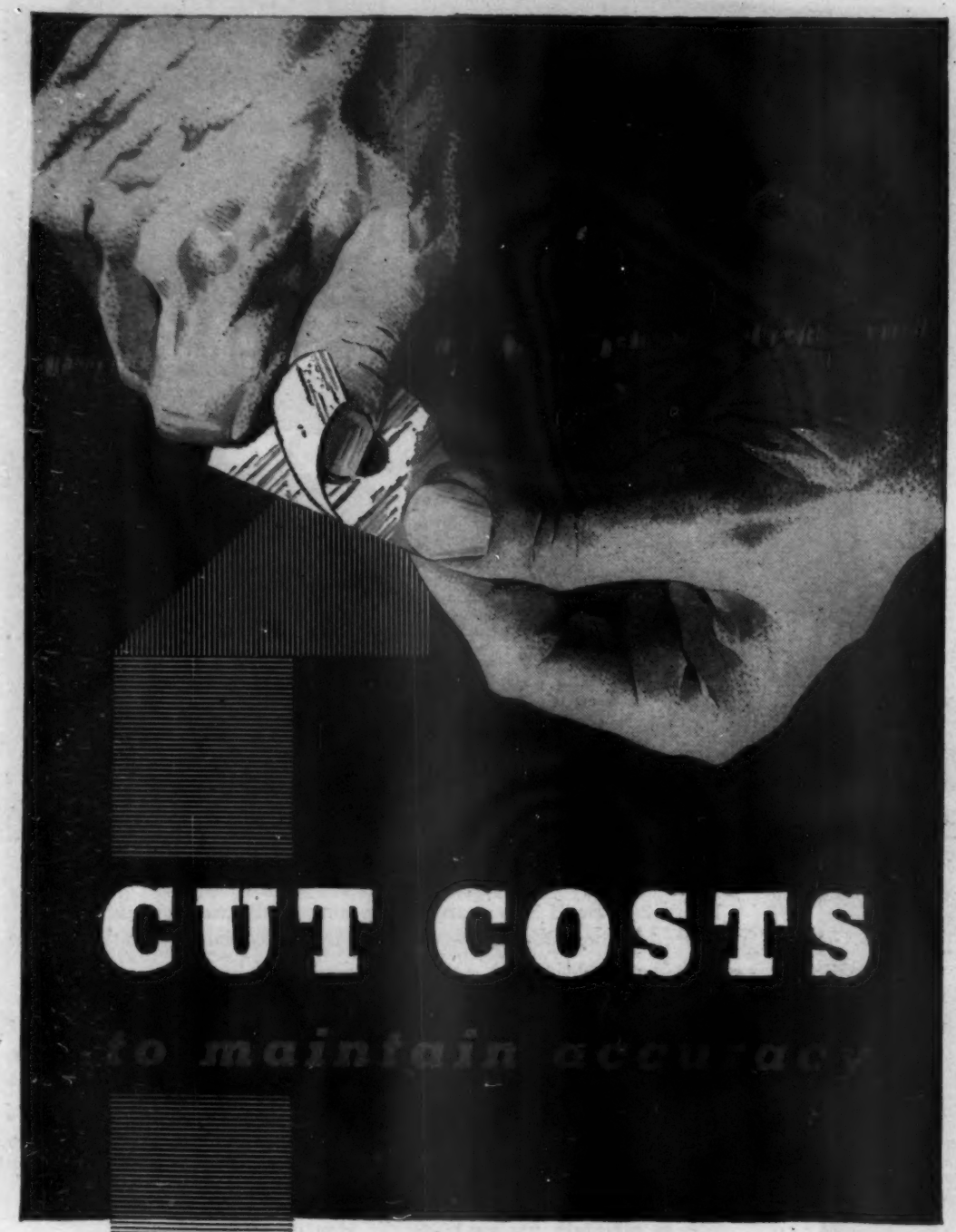
City.....(...) State.....



LAMINUM, the "solid" shim that peels for adjustment, cuts costs by eliminating costly grinding to attain the close fit required for precision production and assembly.

Peel the required laminations of precision brass from LAMINUM. Without miking or filing, you will have correct shim thickness.

Costs are cut. Close tolerances are maintained. And, users' repair and maintenance time is reduced.

Write for data and application chart.

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LAMINUM shims are cut at our factory to your exact specifications. Shim stock for repair and maintenance work is sold exclusively through industrial distributors.

Laminated Shim Company, Inc.
Glenbrook, Connecticut

3030

LAMINUM
TRADE MARK

THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

centrifugal impeller, it cannot beco overloaded, it is said, regardless of length of the duct used. Construc of aluminum, it is designed for mount on the outside wall with its louve inlet extending through and connect directly to the duct system. Suited applications such as process tanks welding fume exhaust. Jenn Products Co., 325 Bankers Trust Bl Indianapolis.

●

VERTICAL GEARMOTOR

Consisting of a high-speed motor speed reducing unit, self-contain vertical gearmotor is made in m different gear ratio combinations, ran ing from 7.61:1 to 38.9:1. Available 3- to 50-hp., 220-, 440-, or 550-v 3-phase, a.c., and 3- to 7½-hp., 115- 230-volt, d.c. units. May be equipp with practically any standard mot Features positive gear and bear lubrication at all operating spee single helical gears and pinions of 40 50 carbon steel, uniform loading, a low impact stresses from sudden shoc or reversals. Westinghouse Electr Corp., P.O. Box 868, Pittsburgh 30.

●

EMERGENCY LIGHT

Lighting automatically when regula power fails, Litezon emergency ligh shuts off automatically when power re turns. Can be used indoors or out. No maintenance is required. Model 1-AL, 11x7x15 inches, weighing 15 pounds, and Model 2-AL, 12x8x15 inches, weighing 25 pounds, have floodlights adjustable to any angle. Built-in voltmeter has pushbutton control for checking bat teries. Indicator lights when connected for emergency use. The light plugs in any standard outlet. Chisholm Mfg. Co., 2 Church St., Watertown, Mass.

●

MATERIALS HANDLING EQUIPMENT

Collapsible pallet box, an all-wood pal let, and a line of accessories for pallet platforms, skids and, boxes are an nounced. The collapsible pallet box with capacity ranging from 2500 to 500 pounds, utilizes an 8-way, all-steel 40x48-in. pallet as a base, and has 8-gage steel wire sides 24 inches high. When

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Complete Line Aids Proper Application — Helps Keep Production Moving

The line of Century Motors is so complete that you can select the *right* motor for all popular applications.

Your motor driven machines may require high, low or normal torque; single speed, multispeed or variable speed; a.c. or d.c. current; open, splash proof, enclosed or explosion proof construction. Most of the popular combinations of these electrical characteristics and frame designs are built by Century.

Many maintenance men say that improper motor selection is too often the cause of production failures. You can reduce these expensive shutdowns by selecting the right Century Motor.

Century builds a complete line of fractional and integral horsepower electric motors and generators in the popular sizes to meet the requirements of industrial production, commercial and appliance needs.

Specify Century for all your electric power needs.

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CENTURY ELECTRIC COMPANY • 1806 Pine Street, St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

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CERTAINLY! when the tape is "SCOTCH" Super Strength. It is common practice in large metal working plants.

Our picture shows pieces of aluminum ridge capping 10 feet long and 12½ inches wide being put up in neat, tight bundles—fifteen pieces in a bundle—fastened at each end with "SCOTCH" Super Strength Tape 2 inches wide. The bundles are then wrapped in waterproof paper and sealed with "SCOTCH" Wetordry Masking Tape. The result is a securely protected product.

It is more than likely that some one or more of the hundred varieties of "SCOTCH" TAPES could save time and money somewhere in your plant. A "SCOTCH" Tape Engineer will be happy to check with you at your convenience. Why not write us today?

MFG. U. S. PAT. OFF.

SCOTCH BRAND **No. 300** *Super Strength* **TAPE**

ANOTHER 3M COMPANY PRODUCT

Made in U.S.A. by MINNESOTA MINING & MFG. CO. St. Paul 6, Minn.

not being used, the wire sides fold do over the top of the pallet. The hardwo pallet, with cement-coated helix dri screws, is made in 48x48-, 48x40-, a 48x36-in. sizes. The accessories inclu short crane lugs that fasten to a skid b to permit conveying by crane and tie ing; long crane lugs for skid boxes wi platforms; skids and platforms with fo holes on sides; bumper runners for sk platforms; skid box stacking and hairp tiering lugs; knee braces for skids a boxes; skids with stake pockets; rol over fork pockets for skids and boxe trunnion and yoke assemblies; tieri posts for stacking pallet-boxes or palle Monroe Auto Equipment Co., Monro Mich.

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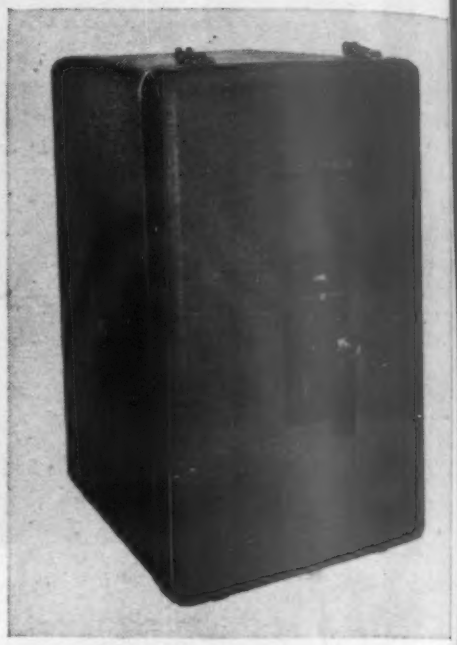


AIR CIRCUIT BREAKER

Designed for use on low-voltage circuits (600 volts and below), Type AK-1 air circuit breaker is available in two ratings. The AK-1-15 is rated 15 to 225 amperes with a 15,000-amp. interrupting rating; and the AK-1-25 is 35 to 600 amperes, with a 25,000-amp. interrupting rating. Accessories can be attached in the field. Has sealed-in overload trips, short-time rating equal to the interrupting rating, silver alloy contact tips, shielded live parts, and an all-metal mounting base. Arcing time with the breaker is less than one cycle. The AK-1 is suitable for selective tripping systems. The breaker can be supplied for individual mounting, or as an integral part of draw-out switchgear equipment. Switchgear Div., General Electric Co., Schenectady 5.

•

DRILL PRESS

Made in bench and floor models, 14-in. drill press uses up to ½-in drill size in iron or steel. A belt tension release lever simplifies changing spindle speeds, and returns the V-mounted motor to its original position after each change. The spindle has 4-in. maximum travel, with spindle speeds of 707, 1305, 2345, and 4322 r.p.m. The depth gage is graduated in sixteenths of an inch, and has adjustable collars. A 10x10-in. tilt-type table has slots for clamping fixtures or work. The bench model has 10⅞-in.

maximum chuck-to-table distance

SERVING YOU by doing things with air

Eye appeal to You!

● From DeVilbiss spray guns come the most eye-pleasing finishes attainable today. On all of the products you manufacture, it's the imprint left by these versatile guns that appeals to the customer's eye before he buys. And, on the outside and inside of your offices and factories, it's the sprayed finish that looks best.

But spray painting has come to mean much more than just eye appeal. It gives a surface more thorough protection, longer-lasting protection. And the exceptionally high speed of spray application helps you produce for less—sell for less. Whether you realize it or not, you cut costs on every item you manufacture that receives its finish the modern, DeVilbiss spray way.

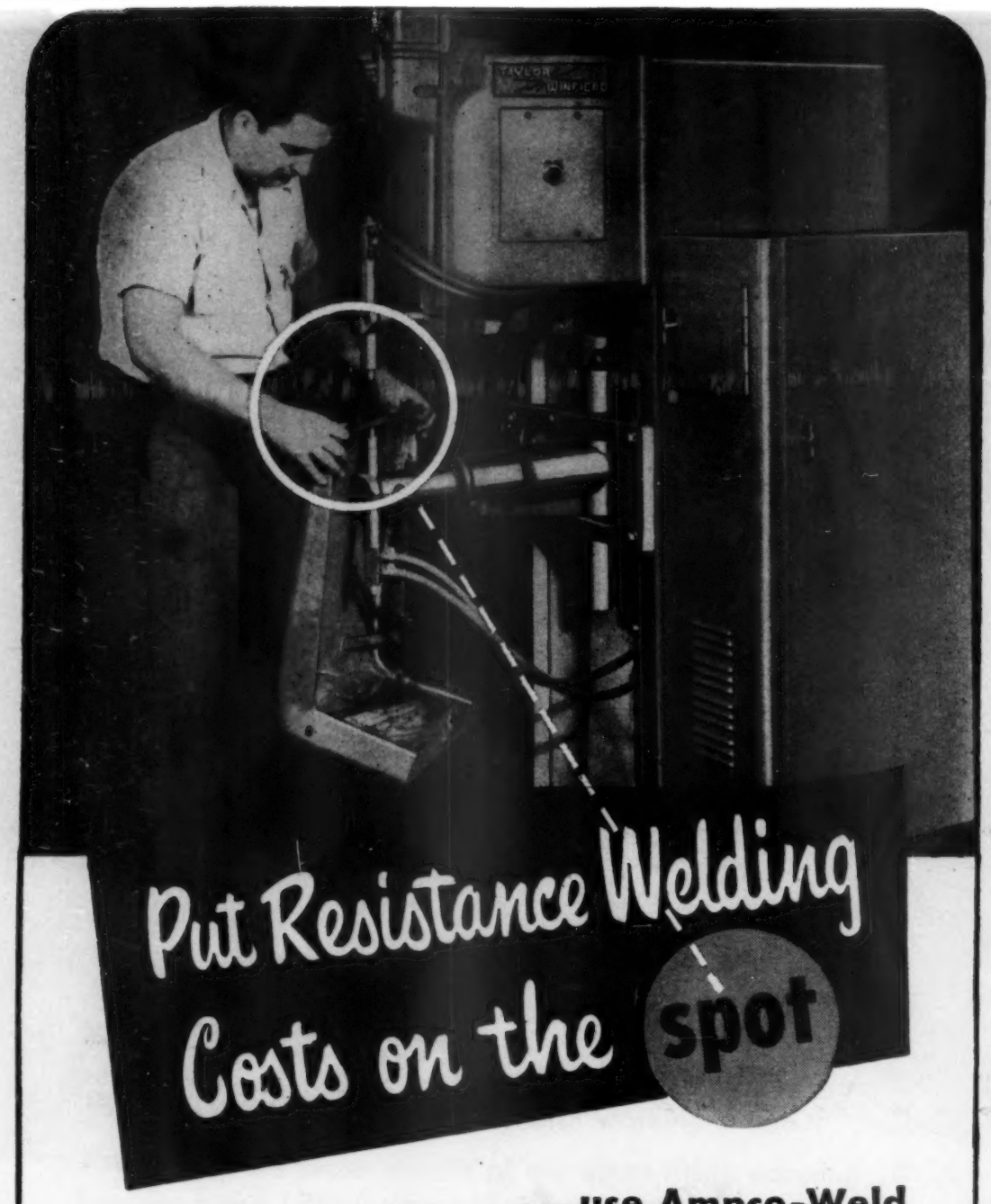
Spray painting, pioneered by DeVilbiss, has advanced steadily in efficiency and range of application through a never-ending parade of DeVilbiss developments. That is why thousands of companies and individuals look to this leadership for the means and knowledge of "how to spray it best—at lowest cost". You too, can profit from all that DeVilbiss offers!

THE DEVILBISS COMPANY, TOLEDO 1, OHIO

Canadian Plant: WINDSOR, ONTARIO

DE VILBISS *means* **Quality** *in all four . .*

SPRAY EQUIPMENT
EXHAUST SYSTEMS
AIR COMPRESSORS
HOSE & CONNECTIONS



Put Resistance Welding Costs on the spot

...use Ampco-Weld resistance welding electrodes in modern equipment...increase the number of welds made, substantially reduce your costs

Sturdy! Versatile! These are the words that best describe this spot and projection welder, because it provides long life operation with a minimum of maintenance.

The same words apply to the Ampco-Weld electrodes used in this machine. Here's why:

Terne plate and galvanized stock, as you know, normally require the use of R.W.M.A. Class I electrodes. Yet, these two items are easily handled by Ampcoloy 97, a Class II alloy that combines the conductivity of Class I with the hardness of Class II. The ability of Ampcoloy 97 to do such jobs gives you clean welding and longer electrode life.

It pays to use Ampco-Weld electrodes in your resistance welding set-up. Get a supply today and see for yourself. The Ampco-Weld line is complete—it includes standard and special holders. All products meet R. W. M. A. specifications. Call your nearest Ampco office. Write for our latest fact-filled bulletin—it is just off the press.

MEMBER RESISTANCE WELDER MANUFACTURERS ASSOCIATION RWMA

Ampco Metal, Inc.

Department FM-3 Milwaukee 4, Wis.

AMPCO

Field offices in principal cities

RW-9

maximum chuck-to-table distance, 10⅞-in. table travel, and 17-in. maximum chuck-to-base distance. The floor model has a 40⅛-in. maximum chuck-to-table distance, 40⅛-in. table travel, and 46½-in. maximum chuck-to-base distance. Supplied with or without ⅓-hp, 1725-r.p.m. vertical-mounting-type motor. South Bend Lathe Works, 2800 East Madison St., South Bend 22, Ind.

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CHANGE IN NAME

Milcor Steel Co., Milwaukee fabricator of sheet metal building products and specialty items, has changed its name to Inland Steel Products Co. It is a subsidiary of Inland Steel Co.

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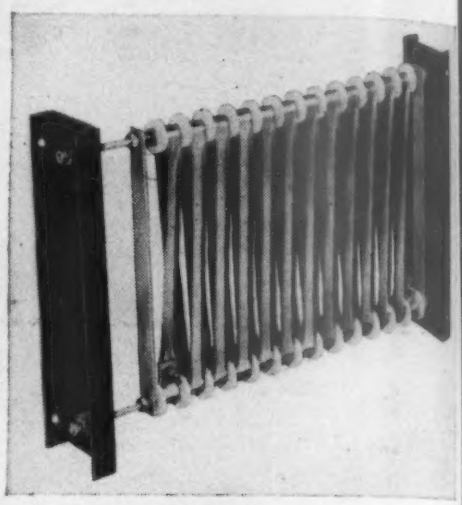


RESISTOR UNITS

Loopohm resistors are intended for continuous-duty, high-current applications where mechanical shock and vibration prevail. They are suitable for use on crane hoists, welding equipment, portable load banks, and controller assemblies. Standard units are available with continuous current capacities from 20 to 110 amperes, and with a range of resistance values. Features claimed are light weight, resistance to shock and vibration, good radiating qualities, adaptable to single- or multi-unit mounting; non-corrosive alloy resistance ribbon, and high current capacity. Each unit is equipped with two end terminals for connection. Ward Leonard Electric Co., Mt. Vernon, N. Y.

•

MULTIPLE DRUM CARRIER

Fork lift truck accessory, the multiple drum carrier, handles as many as four drums by means of hydraulically operated gripping shoes. Mechanical and gravity action are said to provide strong, positive grip for stacking of drums to utilize overhead storage area. Also suitable for loading drums into freight cars and trucks. Towmotor Corp., 1226 E. 152nd St., Cleveland 10.

•

POWER SWEEPER

Waste materials can be collected indoors as well as out by all-purpose power sweeper. Said to get in close to walls, curbs, trees, and fences, it is operated with single controls. It has a cast aluminum frame with a cover of 20-gage sheet steel, and rides on 10x2.75 zero-

NEW SIMOMETER

gives you accurate

TESTED TENSION

in less than 1 minute per blade

Here's how SIMONDS Quick and Easy Tensioning Method gives you LONGER BLADE LIFE!

Avoid Undertension which causes crooked cutting, spoiled work, lost time.

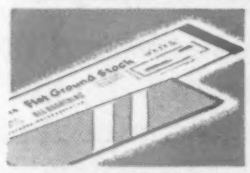
Avoid Overtension which causes blade-vibration, rapid dulling of teeth, frequent blade-breakage.

Slip the *Simometer* Directly over Blade, tighten two thumb-screws . . . now put tension on blade until **Simometer** needle moves into green zone . . . and you *can see at a glance* you have the right tension on the blade.

Then You're Set to get Faster, Straighter Cuts... and more cuts per blade . . . *the full measure* of performance which **SIMONDS** "Red End" Power Blades are made to give you. Ask your distributor.

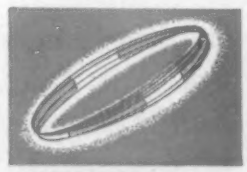
BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Avenue, Portland 4, Ore.; 51 W. Trent Ave., Spokane 8, Washington. *Canadian Factory:* 595 St. Remi St., Montreal 30, Que.

SIMONDS ALSO MAKES:



FLAT GROUND STEEL STOCK (Oil Hardening)

"RED TANG" FILES



METAL-CUTTING BAND SAWS (Regular Hard Edge, Skip-Tooth, Spring Temper)

CIRCULAR METAL-CUTTING SAWS (Inserted-Tooth, Segmental, Solid-Tooth)

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

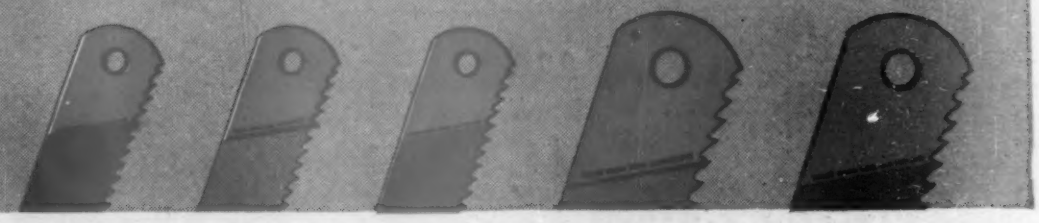
Other Divisions of SIMONDS SAW AND STEEL CO., making Quality Products for Industry

SIMONDS STEEL MILLS — Special Electric Furnace Steels

SIMONDS ABRASIVE CO. — Grinding Wheels and Grains

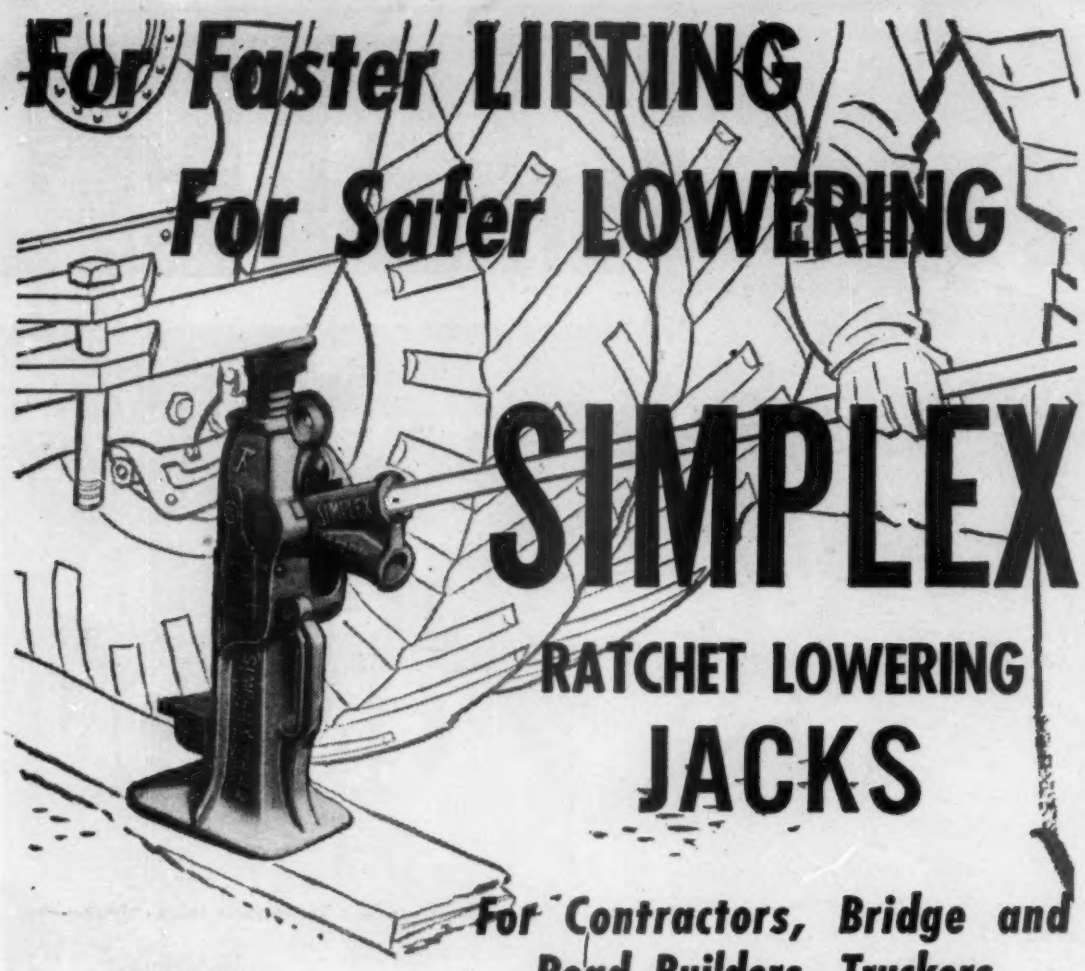
SIMONDS CANADA SAW CO. LTD. — Simonds Products for Canada

SIMONDS "Red End"
HACKSAW BLADES



WHEN YOU USE SIMONDS YOU STAY IN THE HIGHLANDS . . . OF CONSISTENT CUTTING EFFICIENCY

For Faster LIFTING
For Safer LOWERING



SIMPLEX
RATCHET LOWERING
JACKS

NO. 22
10-TON CAP.

For Contractors, Bridge and Road Builders, Truckers, Operators of Heavy Equipment

Use these single acting jacks for safe, sure work in lifting, lowering, pushing or pulling. Double lever sockets speed work in cramped quarters and in angular lifting. All models will lift full capacity on the toe or on the cap — a feature that only Simplex can give you.

Best materials are used throughout for rugged, long-life operation, by the manufacturer awarded the only gold medal for the safety of jacks by the American Museum of Safety.

SIMPLEX HYDRAULIC JACKS

For heavy duty work in shops ard factories, in construction and transportation. Powerful hydraulic operation. Available in eight models to handle from 3 to 100 tons —tested to 100% overload. Write for Bulletin HJ-47

Available in 10 models with capacities ranging from 5 to 20 tons, and lift from 7 to 18 inches. All have two-way standard lever socket except three largest models; these are available with any of three types of sockets. Delivered with lever included.

For full information, write for Bulletin: Industrial 48.

Simplex
LEVER - SCREW - HYDRAULIC
Jacks
TEMPLETON, KENLY & COMPANY
1018 South Central Avenue • Chicago 44, Illinois

pressure tires and ball-bearing wheels. Driven by a 1½-hp., air-cooled, 4-cycle gasoline motor, the sweeper has rotating brushes, a floating axle, aluminum brackets, full shaft, and ball-bearing mountings. May be obtained with or without traction-power drive. Wilshire Power Sweeper Co., 3636 East Foothill Blvd., Pasadena 8, Calif.

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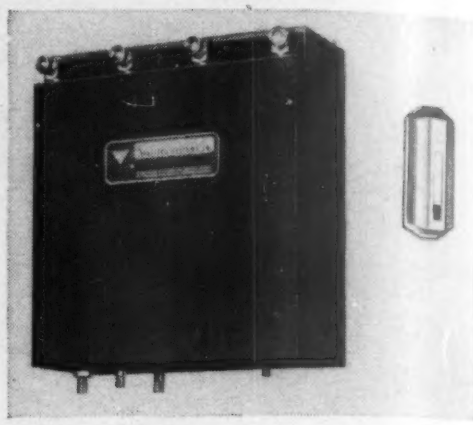


HUMIDIFIER

Self-contained humidifier, built into a 13⅞x14¾x6-in. cabinet, consists of four humidifying nozzles, water tank with float valve, water strainer, air filter, air regulator with pressure gage, and solenoid-operated valve. The humidistat for automatic control is not attached to the cabinet, but may be installed separately. Individually adjustable nozzles direct the spray as required. Suitable for air or water lines, or for electrical circuits, the standard 4-nozzle model will atomize 35 pounds of water per hour using 5 c.f.m of air supplied at 32 p.s.i. Units suitable for smaller capacities available also. Spraying Systems, 4021 W. Lake St., Chicago 24.

•

BENCH GRINDER

Equipped with 6x¾x½-in. abrasive wheels, 6-in. bench grinder, called Reddy, is built for general-purpose grinding. The motor is ⅓-hp. capacitor type, ball bearing, totally enclosed, with 3450-r.p.m load speed. Grinder features tool rests adjustable to wheel wear; 7-ft. 3-conductor rubber-covered cable, Underwriters approved, with one wire for grounding, and attachment plug; rubber feet; and provision for bolting to floor. Can be furnished for 110- or 220-volt, 50- or 60-cycle, 1-, 2-, or 3-phase a.c. operation. The United States Electrical Tool Co., Findlay St., Cincinnati, 14.

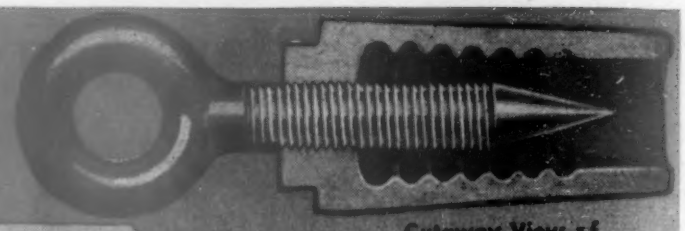
•

PORTABLE REPAIR UNIT

Flexible-shaft machine mounted on a mobile cabinet contains 25 accessory tools and 24 supplies for on-the-spot repairs. Power is supplied by a ⅓-hp. motor, 110 or 220 volts, 60 cycles a.c. The flexible shaft is 5 feet long, and has a non-metallic innerliner. Internally controlled flexing is built in shaft housing to eliminate heating, kinking, or whipping. Speeds of 1400, 2400, and 4500 r.p.m., with V-belt drive are provided. The steel cabinet, with three caster legs, is equipped with shelves for the tools. Tools and accessories include

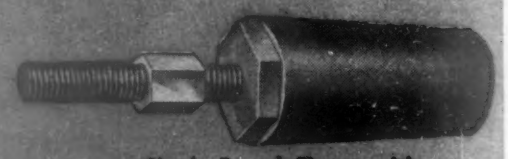
CLARK

SCREW JACK CLAMPS SIMPLIFY STRANDED CABLE INSTALLATIONS

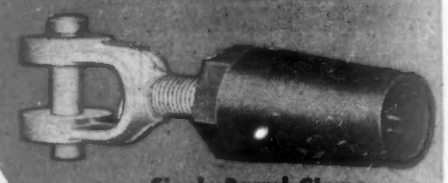


Cutaway View of Single Barrel Clamp

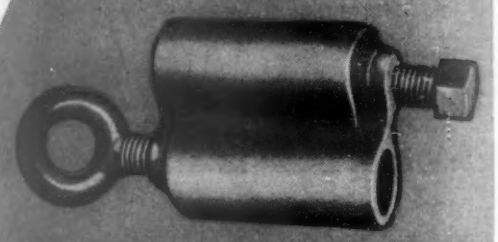
Single Barrel Clamp with Eyebolt



Single Barrel Clamp with Double Ended Straight Stud



Single Barrel Clamp with Clevis Bolt



Double Barrel Clamp . . . Barrels Parallel

Double Barrel Clamp . . Barrels at Right Angles

Cable Splicer . . Complete

CLARK Screw Jack Clamps are used for making dead ending connections and taking off taps in main and feeder power cables. The cable splicer consists of two single barrel clamps, with a pointed capscrew in each, joined together by a threaded center barrel. The clamps are threaded in opposite directions to permit the joint to be made without twisting the cable. After the cable strands have been wedged into the grooves inside the barrels, a strong and durable joint is made by simply screwing on the connecting, or center barrel. If it is desired to re-open the joint, a few minutes is sufficient to do the job. No time required to heat up and melt solder—simply unscrew the parts.

The body, or barrel, of the CLARK screw jack clamp is high tensile strength bronze. Grooves inside the barrel lock the cable in a powerful grip when the pointed end of the anchor bolt is forced between the strands.

These screw jack clamps are available in either single or double barrel construction for the cable sizes listed.

CABLE SIZE in Circular Mills	
Minimum	Maximum
4/0	350,000
One B arrel 350,000	350,000
Other B arrel 400,000	550,000
400,000	550,000
One B arrel 400,000	550,000
Other B arrel 1,500,000	1,500,000
600,000	750,000
One B arrel 600,000	750,000
Other B arrel 1,500,000	1,500,000
1,000,000	1,250,000
Rope La d Cable 1,000,000	1,250,000
1,500,000	1,500,000
2,000,000	2,000,000

Single barrel clamps are furnished with three kinds of bolts according to purchaser's specifications. Clamps for plain dead-ending are furnished with an eyebolt; clamps for use with strain insulators may be furnished with either a double ended straight stud, or a clevis bolt. Standard double barrel clamps are furnished in two styles: Barrels parallel and barrels at right angles. In either style, one barrel contains an eyebolt, and the other barrel contains a pointed hex head cap screw . . . A clevis bolt or a double ended straight stud may be substituted in place of the eyebolt.

In the 1,000,000 to 1,250,000 circular mill sizes, cable known as "Rope Laid" is often used. This cable is slightly larger in normal diameter than the circular mill size indicates so special screw jack clamps are made to accommodate the cable.

Write for Bulletin 105

EVERYTHING UNDER CONTROL

THE CLARK CONTROLLER CO.

1146 EAST 152nd STREET, CLEVELAND 10, OHIO

Planning a

Chemical Plant Oil Refinery Paper Mill?

...or an addition?

You can now get ASBESTONE

Asbestos-Cement Corrugated Roofing & Siding

—the lifetime roofing and siding that's fireproof and corrosion-proof. Asbestone can't be damaged by weather, rats, or termites. No painting. No upkeep.

Here are a few of the many prominent users:

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ETHYL CORPORATION
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NEW ORLEANS PUBLIC SERVICE
MOBILE PAPER MILL CO.
CROSBY CHEMICALS, INC.
STANDARD OIL OF N. J.
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We are concentrating on production of this single industrial product. Stocks are now ample to make some immediate shipments. Free Engineering Service available on request, shows how Asbestone can be adapted to your needs.

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5300 TCHOUPITOULAS STREET NEW ORLEANS 15, LA.

Specialists in Asbestos-Cement Building Products for over 25 Years

equipment for sanding metal or wood, for drilling, wire brushing, grinding, buffing, sawing metal or wood, filing, carving, removing paint or varnish, waxing, and other repair work. Wyzenbeek & Staff, Inc., 838 West Hubbard St, Chicago 22.

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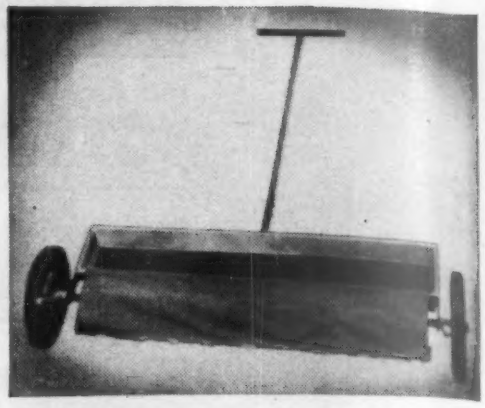

MAGNETIC SWEEPER

Loose nails and scrap metal can be removed from loading yards or other areas by magnetic sweeper. Units are made in sizes from 12- to 72-in. sweeping widths. Series of permanent Alnico magnets are mounted on alloy steel axle with rubber-tired, ball-bearing wheels. Canvas cover fastens to retainer pan, passing over assembly and under magnets where it is held by small steel rod in end of canvas. When magnets are loaded, the operator pulls the metal rod in free end of canvas back toward handle until iron trash falls into the pan. Columbia Eng. Svce. Co., 593 Market St., San Francisco.

•

FLOW CONTROL VALVE

Controlling air or hydraulic cylinder speed, a flow control valve is claimed to assure full use of air or hydraulic cylinder power, because it eliminates abnormal pressure of the exhaust from the return side of the cylinder. When flow is *to* the cylinder (in either direction) the ball check closes and flow path is directed through flow control valve, which has a range of adjustment. Reverse flow *from* the cylinder is unrestricted because the unloaded ball check opens on a slight change in pressure. The valve is slightly larger than the pipe size, to permit compact piping arrangements. Made in ¼-, ⅜-, and ½-in. pipe sizes from brass hexagon roll bar stock, with parts of stainless steel. Pneu-Trol Devices, Inc., 3122 North California Ave., Chicago 18.

•

TRANSFORMER TEMPERATURE INDICATOR

Yellow hands and numerals on blue-gray background are designed for high visibility on transformer temperature indicator. An oil-tight mounting well permits removing and installing the unit without changing the oil level or disconnecting the transformer. Fogging of cover glass from condensation is said to be eliminated by the weatherproof construction. A red maximum-temperature-indicating hand is reset by wiping a small magnet over the face of the cover glass. The magnet is secured on a light

chain, and between resettings is screwed in a hub on the side of the instrument. An alarm contact for indicating a predetermined temperature also is available. Westinghouse Electric Corp., P.O. Box 868, Pittsburgh 30.

•

HEATING TORCH

Hand-sized self-contained heating torch, which burns butane or propane gas, is made for soldering, brazing, and heating operations. It is 12 inches long, 2¼ inches in diameter, weighs 2½ pounds when full, and is said to give 8 hours' burning time with a 3800-deg. F. flame. Made of 16-gage seamless brass tubing, the torch has a pressure capacity of over 2200 p.s.i. Operating pressure is 90 to 150 p.s.i., and other features include fingertip control of flame size and temperature, and a patented all-in-one tip. It is suitable for sealing sweat joints, lead burning, sealing batteries, paint burning, radio and armature repairing, and heating and forming composition floor tiles. Sully Engineering, Ltd., 7416 Melrose Ave., Los Angeles.

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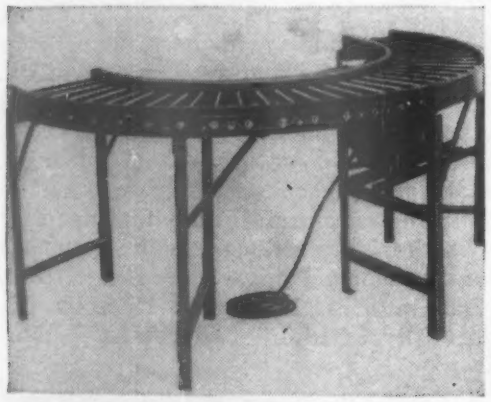


CONVEYOR CURVE

"Streamliner" power-driven conveyor curve is made in 90- and 180-deg. units. Rollers are 2 inches in diameter, set in 3½ in., 10-gage steel formed channels, on either 4- or 6-in. centers. They are available in widths between channels from 10 to 30 inches in 2-in. increments, and operate at a constant speed of 45 f.p.m. Minimum height is 18 inches. The drive is a ⅓-hp., 115/230-volt, 60-cycle, single-phase reversible motor, with reducer and chain drive. Harry J. Ferguson Co., 149 West Ave., Jenkintown, Pa.

•

PROTECTIVE COATING

Called No. 88, a pigmented vinyl resin coating can be dispersed in water. It will resist most dilute acids, maker says; is unaffected by alkaline cleaning com-

"Hold it, bub!"

"No jay-walkin' here! Gotta get to the airport? To Air Express those packages? My poor friend — haven't you heard?

"Air Express picks up those packages right at your door here, and delivers *at no extra cost.* There's no waiting around, because Air Express goes on every flight of the Scheduled Airlines. No U.S. point is more than hours away!

"And rates are low. Don't interrupt me—I said *low.* Why else do business men use Air Express to ship finished items, replacement parts and perishables *regularly?*"

Specify Air Express-World's Fastest Shipping Service

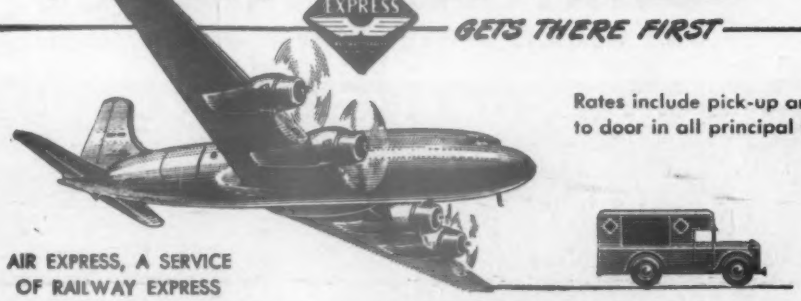
- Low rates—special pick-up and delivery in principal U.S. towns and cities at no extra cost.
- Moves on all flights of all Scheduled Airlines.
- Air-rail between 22,000 off-airline offices.

True case history: Machine parts made in Camden were needed in Chicago in a rush. 32-lb. package picked up the 28th at 10 A. M., delivered same day at 5 P. M. 669 miles, Air Express charge only $6.88. Gave days more time to complete the job. Other weights, any distance, similarly inexpensive and *fast.* Just phone your local Air Express Division, Railway Express Agency, for fast shipping action.

AIR EXPRESS

AIR EXPRESS

GETS THERE FIRST



Rates include pick-up and delivery door to door in all principal towns and cities

AIR EXPRESS, A SERVICE OF RAILWAY EXPRESS AGENCY AND THE

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Cut MAINTENANCE COSTS

Saves hours of time and hard work, and avoids parts breakage, in removing and replacing bearings, races, pinions, collars, pulleys, gears, sleeves, hubs, fly wheels, shafts, and other close-fitting parts. OTC is the only COMPLETE line of Pullers, Attachments and Special Tools. APPROVED by all leading bearing manufacturers.

INDUSTRIAL MAINTENANCE SET No. PE-20

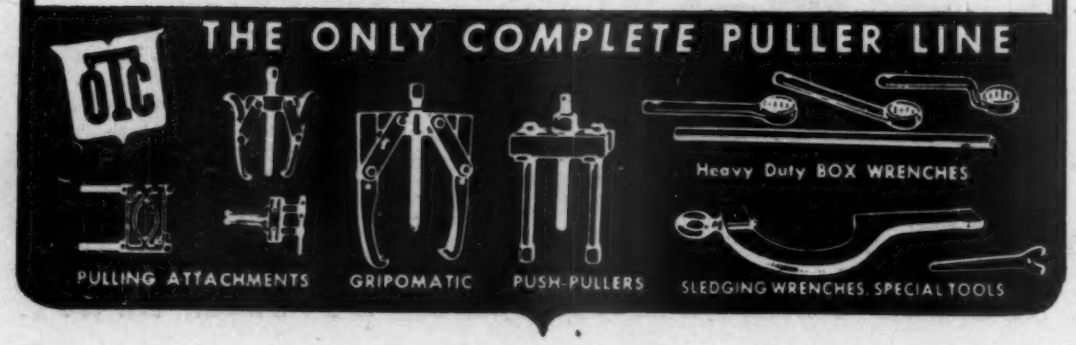
—developed especially for use on heavy machine tools, turbines, marine engines, mining machinery and other heavy equipment. Includes GRIPOMATIC PULLER of 70,500 lb. rating, Heavy Duty PUSH-PULLER with Extension Legs, Pulling Attachments and Heavy Duty Box Wrenches. Other OTC MAINTENANCE SETS of smaller capacity to provide complete pulling equipment at minimum cost for all factories, mills, utilities, R.R. shops, construction contractors, etc. Handy, sturdy service boards available.

AUTHORIZED DISTRIBUTOR OTC MAINTENANCE TOOLS

ASK YOUR SUPPLY HOUSE or write for new Industrial Maintenance Bulletin PE-1946. It's a helpful guide to more efficient maintenance; shows many applications of OTC TOOLS in repair operations.

Look for THIS SIGN

OWATONNA TOOL CO.
363 CEDAR STREET, OWATONNA, MINN.



pounds normally employed as detergents; resists aliphatic alcohols and most aliphatic petroleum hydrocarbons; is waterproof and weatherproof; is unaffected by animal and vegetable oils; will not support growth of bacteria, mold, and fungi; does not sag or run on vertical walls; and levels well. Producing a thick film with fewer coats, it can be applied with a brush or spraygun, air drying without baking. Can be used on concrete, masonry, or wood surfaces, and will not soften or lift old paint. Amercoat Div., American Pipe & Construction Co., Dept FMM, P.O. Box 3428, Terminal Annex, Los Angeles 54.

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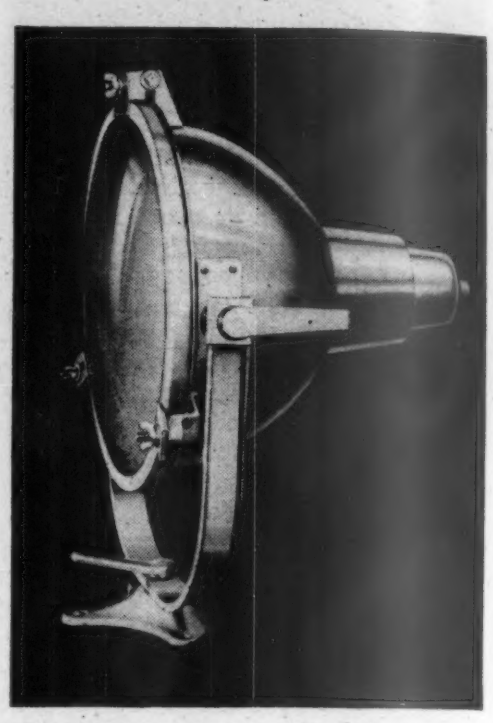

FLOODLIGHTS

Weather-resistant aluminum floodlights, available in 200- to 1000-watt lamp sizes, come with a silvered-glass Permaflector and a convex heat-resisting glass lens. Lens diameters range from 8⅜ to 18¾ inches. The floodlight housings are spun from one piece of sheet aluminum. Design and construction are said to assure maximum illumination under all weather conditions, with minimum maintenance. Approved by Underwriters Laboratories. Pittsburgh Reflector Co., 410 Oliver Bldg., Pittsburgh 22.

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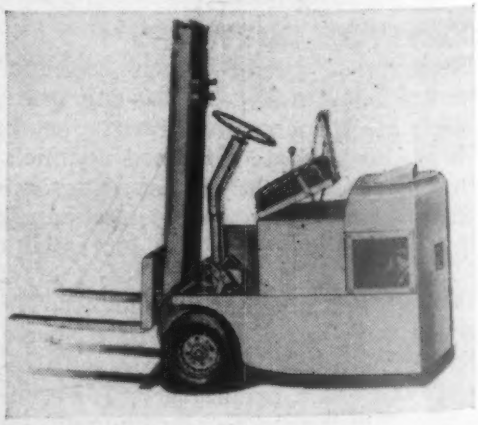
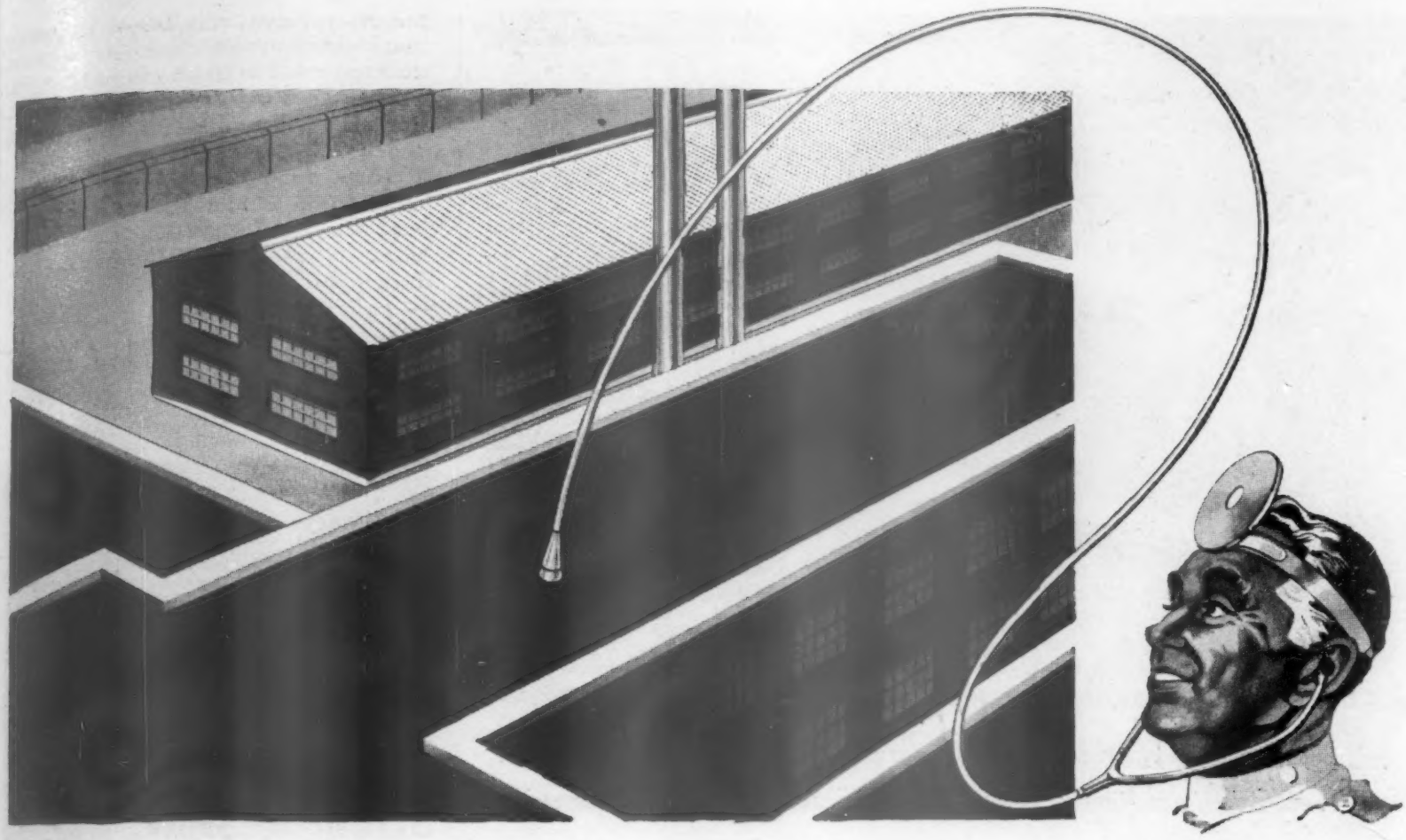


FORK TRUCK

Added to Chore Boy line, a 2000-lb. fork truck, named Thrifty Lift, is powered by a twin-cylinder Onan gasoline engine developing a 10-hp. maximum. Piston displacement is 38.8 cubic inches. Lift and tilt mechanism is hydraulic. The



. . . has your *roof* seen a *doctor* lately?

announcing a Carey service you can't afford to miss

NOW *a Free "Roof-Check" Service* is offered by **CAREY.** Here's what it is and how it works.

THE BASIS — Carey laboratory technicians and roofing engineers, backed by 75 years of experience in serving the roofing needs of American Industry, developed the **CAREY** "Roof-Check" method. It applies to all types of roofs. It is a scientific method of analyzing roof conditions which more and more industrials are using to assure maximum service at minimum cost from existing roofs.

THE PROCEDURE—You simply ask for a Carey "Roof-Check" survey of your property. A roof specialist does the rest. There is no obligation.

THE RESULT—You get a complete written report of the condition of your roof. It gives you detailed information about your roof and includes data on condition of flashings, parapet walls, gutters and all spots where trouble may start. It tells what, if any, maintenance or repair is needed, and the approximate cost. If none is required, the report says so.

"ROOF-CHECK" is a professional diagnosis for existing roofs. It has been created to help building owners understand and appreciate roof maintenance and to provide better longer-lasting roofs at lower overall costs.

75 years serving home and industry

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• This A-F Engineered Conveyor System Will Make Your Mouth Water!

TO BE DOUBLY certain of speed, efficiency and cleanliness in the handling of fresh vegetables for a California packer of frozen foods, A-F solved a difficult and unique problem in designing, engineering and building this A-F Completely Co-ordinated Conveyor System.

A traveling stainless steel wire mesh belt conveys vegetables into pressure blanchers. . . . "Fog nozzles" designed especially for this installation provide a cooling spray. Sanitary stainless steel mesh and sanitary rubber belt conveyors as well as a sanitary disposal system speed sorting, inspection, and processing . . . and eliminate losses from spoilage in handling.

Our know-how has helped solve conveying problems for leading manufacturers the world over! Our engineers are at your service. May we discuss *your* handling problems with you? Write—without obligation—today.

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CONVEYING EQUIPMENT

CONVEYING A-F MACHINERY **Alvey-Ferguson**

METAL PRODUCTS CLEANING EQUIPMENT

unit is available with lifts of 7, 8, or 9 feet. Rubber cushion tires, 16x4 inches, are standard. The truck can be changed from forward to reverse without using gear shift lever, allowing operator to keep both hands free for steering. Overall truck dimensions are—length (less forks), 63⅜ inches; width, 32 inches; wheelbase, 33 inches. Outside turning radius is 59 inches. The Buda Co., Harvey, Ill.

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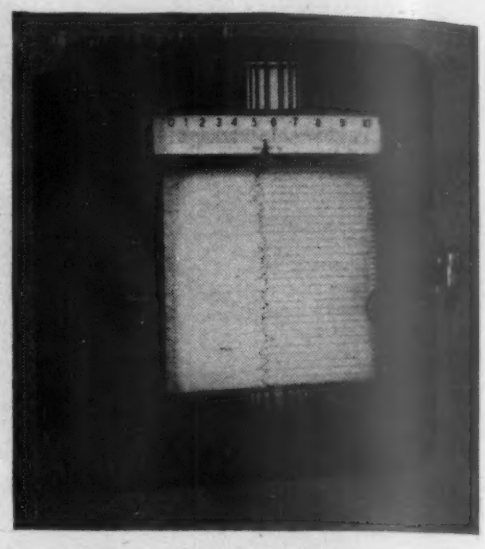

OXYGEN RECORDER

Checking on combustion efficiency in furnaces and boilers is the function of Micromax oxygen recording equipment. Suitable for use as a guide to regulating excess air in furnaces where carbon dioxide is evolved by process reactions, and for checking combustion in boiler furnaces which fire several fuels simultaneously or in succession. The instruments operate on the thermal conductivity principle. Analysis for oxygen is made by the "hydrogen-difference" method, consisting of adding hydrogen to the gas sample, removing oxygen by combustion, and electrically comparing the conductivity of the sample before and after oxygen is removed. All parts in contact with gas are made of glass. Available in two models—for extra visibility of scale, a round-chart type; and for detailed record, a strip-chart model. Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44.

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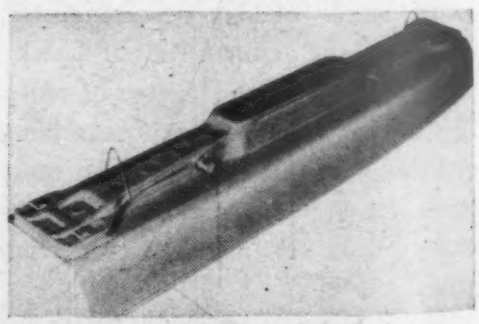


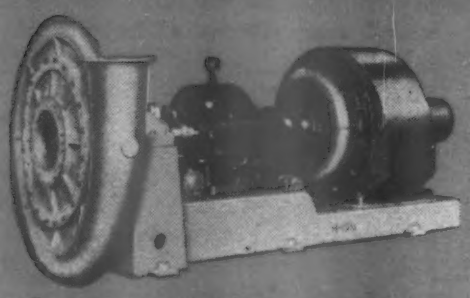
FLUORESCENT FIXTURE

"Weatherized" finish on the reflector of the HF-100 fluorescent fixture is said to protect the metal fixture parts from rust, corrosion, and pitting in damp and deteriorating atmospheres, yet provide a reflection factor of 86 per cent. The turned-down reflector lip minimizes collection of dust, lint, and moisture. The top housing is made from a single sheet

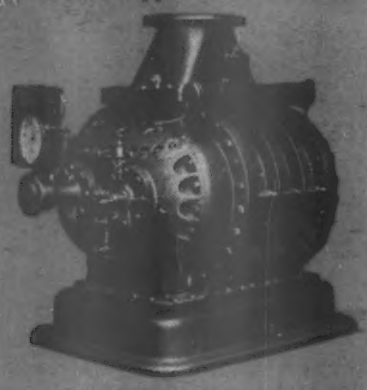
The Solvay soda process was commercially perfected in 1864. Ten years earlier, the first "Roots" Blower was produced. We're not good because we're old . . . but old because we're good.

MOVING! MIXING! MEASURING!

We give Chemicals a ride



From our standard sizes of Centrifugal and Rotary Positive Blowers, capacities are available from 5 CFM up, for separate or built-in application.



Rotary Positive Meters measure gases with cash-register accuracy, from 1,000 CFH to 1,000,000 CFH.

Most industries can profit from the experience of chemical processors in the use of Roots-Connersville equipment. Air, gas and solid particles are pushed or pulled through pipes by R-C Blowers and Vacuum Pumps. Mixtures are agitated and aerated. R-C Meters accurately measure gas input and output. Our Liquid Pumps move viscous liquids efficiently and economically.

For blowers, especially, we offer you an exclusive, important advantage. That is, our *dual-ability* to supply either Centrifugal or Rotary Positive units. Because we build both, we can recommend, without bias, the type which will do the job best. Only Roots-Connersville makes available this *dual choice.*

Our wide experience in the application of blowers and similar equipment is at your service. We help many industries to improve processes and products and to reduce costs. Consult us, without obligation.

ROOTS-CONNERSVILLE BLOWER CORPORATION

803 Central Avenue, Connersville, Indiana

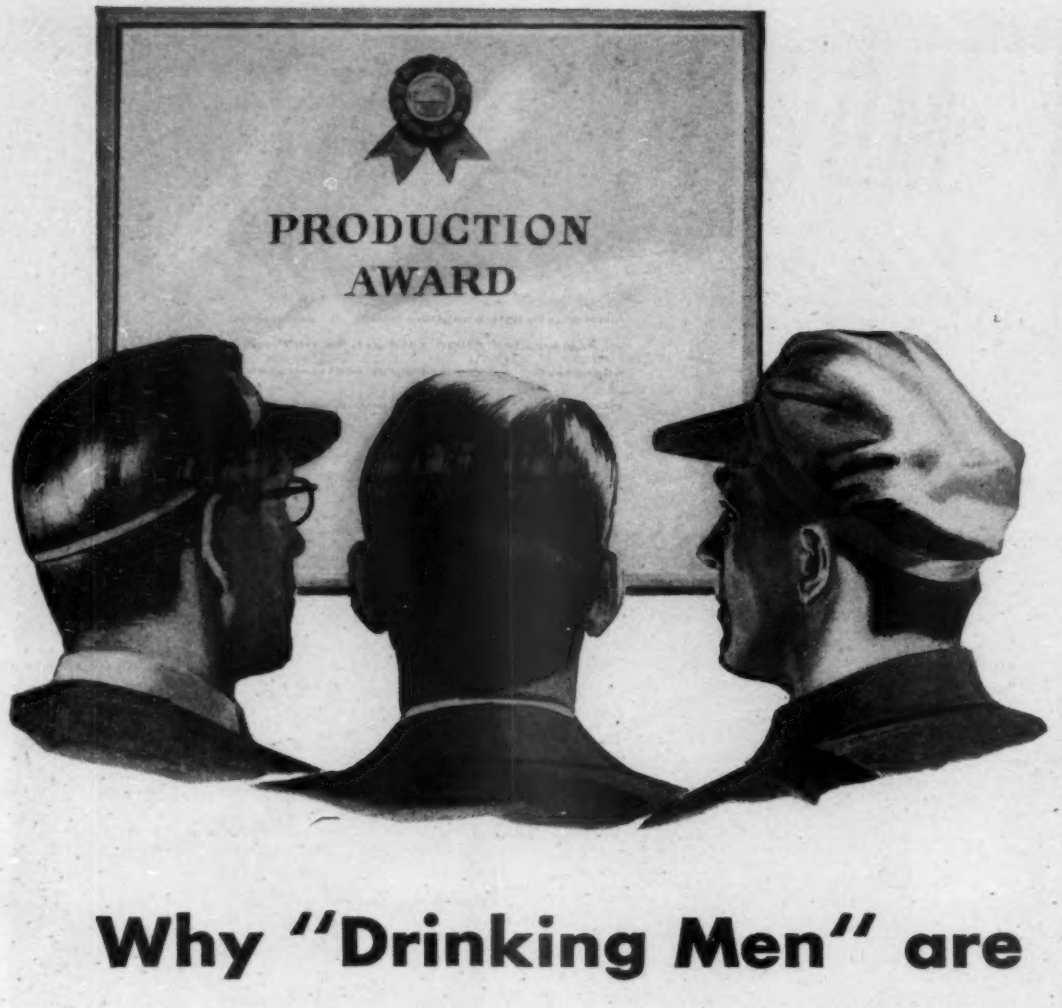
ROOTS-CONNERSVILLE

ROTARY CENTRIFUGAL

BLOWER BUILDERS R-C SINCE 1854

BLOWERS • EXHAUSTERS • BOOSTERS • LIQUID AND VACUUM PUMPS • METERS • INERT GAS GENERATORS

• • ONE OF THE DRESSER INDUSTRIES • •



Why "Drinking Men" are the best workers

YOUR WORKERS' efficiency may drop off sharply if they do not drink as much water as they lose through perspiration. In bringing out this fact, recent scientific studies* also state "during work, men never voluntarily drink as much water as they sweat."

That's why it's good business to encourage drinking with plenty of General Electric Water Coolers in easy-to-get-at places around your plant. These G-E Coolers provide clean, cool water at an operating cost of only a few cents a day.

G-E Water Coolers are available in the convenient foot pedal bubbler-type and also the bottle-type for use where water supply is limited.

Make certain every one of your workers is getting all the water he needs for top efficiency. Call your General Electric Dealer today. *General Electric Company, Air Conditioning Department, Section W8723, Bloomfield, N. J.*

*American Journal of Physiology
Vol. 142, No. 2

GENERAL ELECTRIC

Water Coolers

of steel, with a wide flange which furnishes a backing for the reflector. Single hanger hooks, for slots on each side of the top housing, are said to assure easy installation. Designed as a two-lamp fixture, it is equipped with knockouts for a third lamp if greater intensity is required. Sylvania Electric Products, Inc., 500 Fifth Ave., New York.

•

STACKING TRUCK
Designed for moving and stacking materials on skid platforms, pallets, or in sectional bins, the JackStacker can be used where there are narrow aisles, congested areas, freight car loading and unloading, or where floor and elevator capacities prevent use of heavy equipment. Having capacities up to 4000 pounds, the truck is available in four models—counterweighted for double-face pallets; straddle type for double-face pallets; pen-end base with lifting arms for handling single-faced pallets; and platform-type for skid platforms. The electro-hydraulic lifting and lowering, and the gear drive traction unit are battery-powered series-wound electric motors. All controls are in handle head. The master drive unit, including traction mechanism, is mounted on articulated linkage. Lewis-Shepard Products Inc., 285 Walnut St., Watertown 72, Mass.

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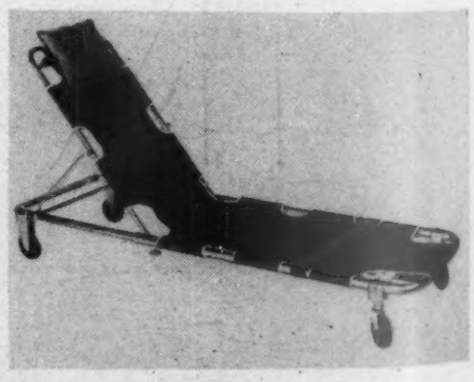


STRETCHER-CHAIR
Known as Collapsi-Cot, a litter can be converted for use as a flat stretcher, transfer chair, and other emergency use. The adjustable backrest can be set to

"I didn't know you people made_____!"

Fill in to suit

We have been in business now for 58 years and yet quite often some good customer of our says — "Why, I didn't know you people made friction clutches!" Or the exclamation might cover skip hoist drives, car pullers, door hoists or any one of many other Jones products.

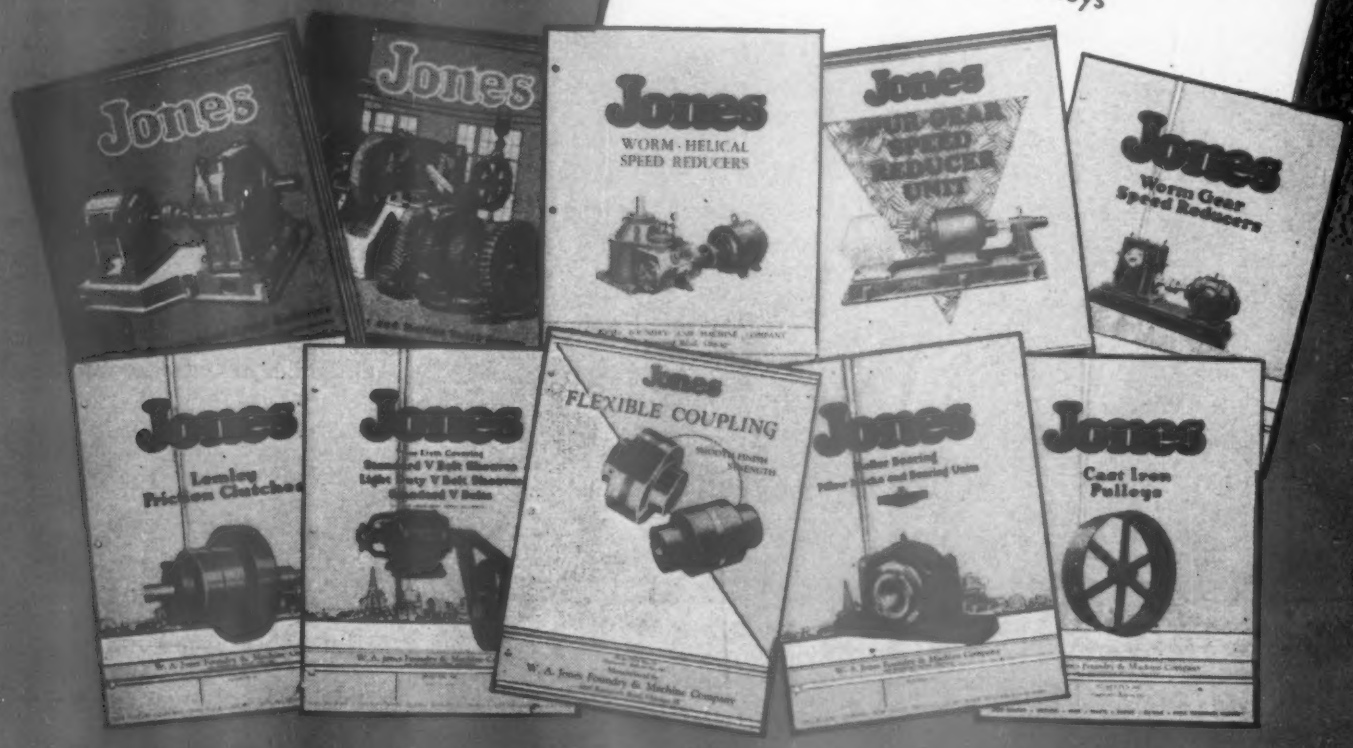
In dealing with our suppliers we often find ourselves in the same position. We establish certain buying habits and it sometimes comes as a shock to find that a firm right around the corner may have just the services or the products we need.

We therefore present the group of catalogs shown below with the thought that some one of them may help you solve some problem that has just come up.

W. A. JONES FOUNDRY & MACHINE CO.
4433 Roosevelt Rd., Chicago 24, Ill.

Any, or all of these Jones Catalogs sent on request

No. 70—Jones Herringbone Speed Reducers
No. 71—Jones Cut Gears
No. 75—Jones Worm Helical Speed Reducers
No. 55—Jones Spur Gear Speed Reducer Units
No. 68—Jones Worm Gear Speed Reducers
No. 60—Jones Friction Clutches
No. 58B—Jones V-Belt Sheaves
No. 78—Jones Flexible Couplings
No. 56—Jones Roller Bearing Pillow Blocks
No. 69A—Jones Cast Iron Pulleys



Jones

HERRINGBONE — WORM — SPUR — GEAR SPEED REDUCERS
PULLEYS • GEARS • V-BELT SHEAVES • ANTI-FRICTION
PILLOW BLOCKS • FRICTION CLUTCHES • FLEXIBLE COUPLINGS

LEWIS-SHEPARD

MULTIPLY MANPOWER • LEWIS-SHEPARD • TRADE MARK

MATERIALS HANDLING EQUIPMENT

"Sign of a Great Line"

Wheeled Materials Handling Equipment ... engineered by 33 years' concentration in this field, these job-tested Lewis-Shepard products include . . . Electric and Gas Power Fork Trucks • Steel Bound Pallets • "JackLift" Electric Trucks • Hydraulic and Mechanical Hand Operated Lift Trucks • Skid Platforms • Hand and Electric Power Stackers • Storage Racks • Hand and Electric Power Cranes • General and Specific Purpose Hand-Trucks.

MR. DOLLAR CONSCIOUS!

YOU SHOULD HAVE THIS CATALOG OF MATERIALS HANDLING EQUIPMENT THE KEY TO NEW PROFITS!

This 84-page book shows you how to apply our 33 years of experience to your business -- and make it pay off.

GET YOUR COPY TODAY!

LEWIS-SHEPARD PRODUCTS INC.

314 WALNUT STREET WATERTOWN 72, MASS.

REPRESENTATIVES IN PRINCIPAL CITIES — CONSULT YOUR PHONE DIRECTORY

any desired degree of positioning. Handling the patient wheelbarrow fashion permits removal through narrow hallways, and, with the backrest up, patients can be transported down stairways head first, without sliding off. Comfort is afforded by the suspended hammock construction, and the elimination of spreader bars. The removable canvas cover can be disinfected and laundered. Shrinkage or stretching can be corrected by adjusting the lacing. The molded rubber wheels lock in upright position by pressing a button. The unit is constructed of cold-drawn seamless steel tubing, with nickel and chrome-plated finish. Emergency Aids Co., 2201 West Winona St., Chicago 25

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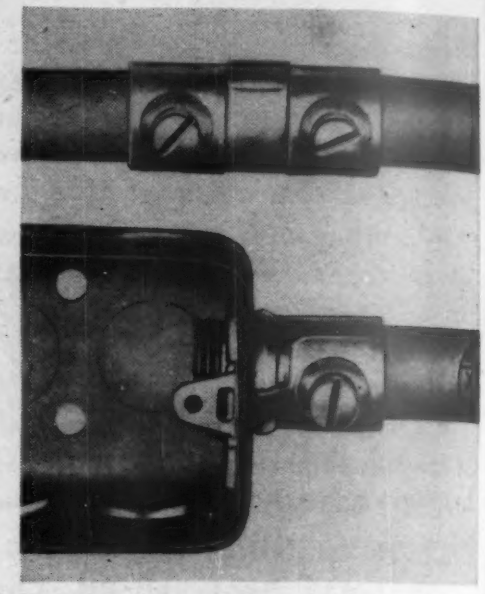


ELECTRIC TUBING CONNECTORS

Line of pressed steel connectors and couplings is designed for use with electric metallic tubing. Having electro-galvanized finish, they are said to be easy to inspect and useful in close quarters and corner installations. The E.M.T. coupling slips over thinwall tubing ends in a close fit. Positioning of the conduit is controlled by a small integral stop. Secure grip is provided by the action of an embedding screw working through a boss. Maker states the coupling and connector assure permanent grounding, vibration-proof connection, simplicity of installation, and re-use. National Electric Products Corp., Chamber of Commerce Bldg., Pittsburgh.

•

PIPE WRENCH

Inaccessible fittings, such as those under sinks, basins, and machinery, can be reached with the Red-E-Basin Wrench;

MISSISSIPPI RIVER MUD is this valve's regular diet

Raw, silt-laden Mississippi River water at 175 p.s.i. had quickly destroyed conventional type valves through abrasive action and corrosion of exposed working parts in Union Electric Company's Venice, Illinois Plant. Then, their own engineers and Stone & Webster Engineering Corporation selected Grinnell-Saunders Diaphragm Valves. These flanged, unlined valves with rubber diaphragms have already served several times longer than previous valves, and are still going strong.

YOU, too, may find your answer to valve troubles due to corrosion, contamination or suspended solids, in

GRINNELL-SAUNDERS DIAPHRAGM VALVES

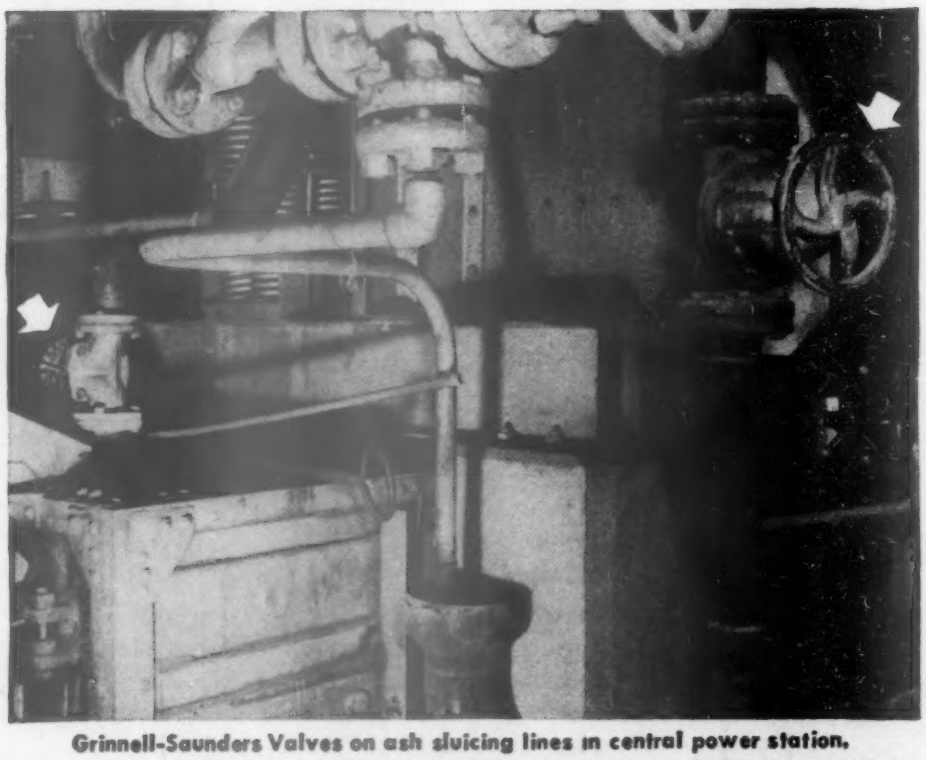
ISOLATED WORKING PARTS — The flexible diaphragm isolates working parts of the valve from the fluid, preventing contamination or corrosion.

CORROSION-PROOF LININGS — A selection of diaphragm materials and also body linings of glass, porcelain, lead, rubber or synthetics to suit your service requirements.

STREAMLINED FLOW . . . POSITIVE CLOSURE — Streamlined passage without pockets minimizes friction. Large area of contact of the diaphragm, plus diaphragm resilience, permit positive closure even when solids are trapped.

Write for catalog—Grinnell-Saunders Diaphragm Valves.

GRINNELL COMPANY, INC.
Providence 1, R. I.



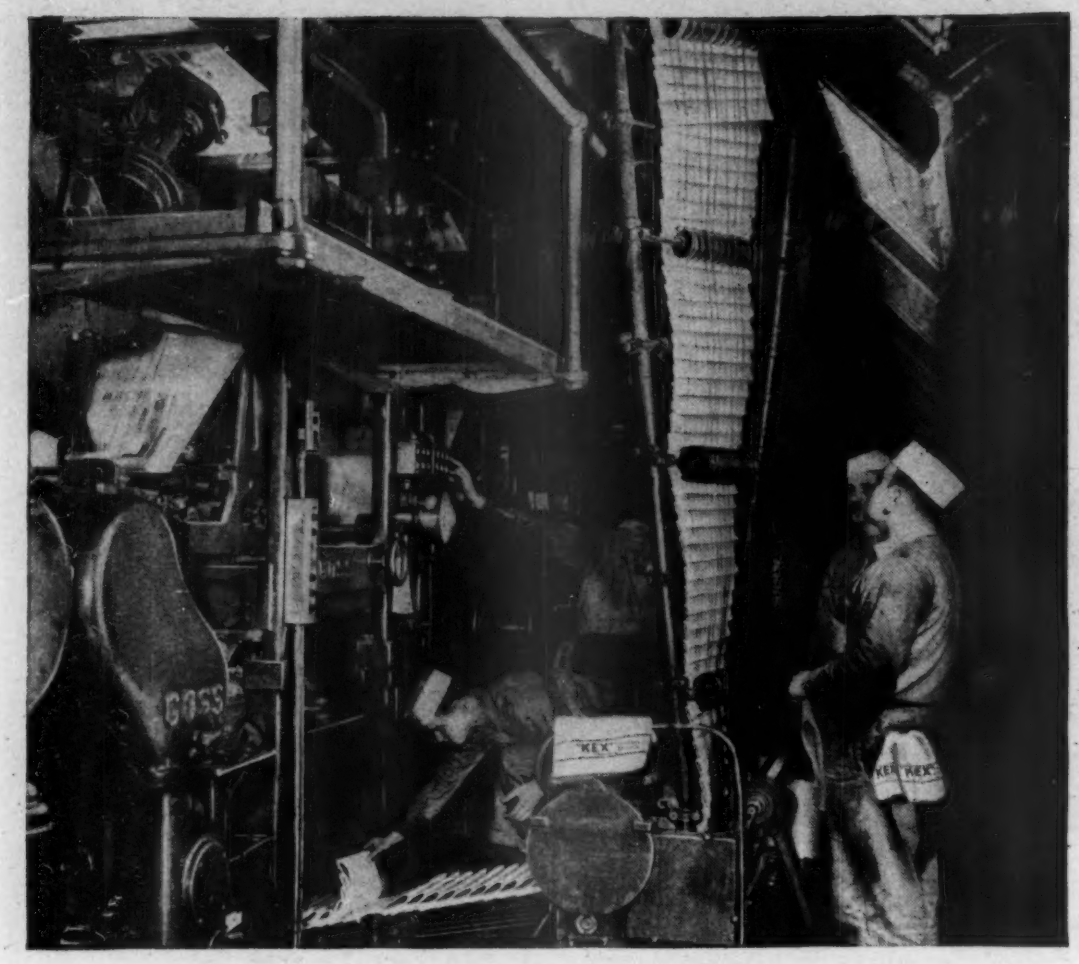
Grinnell-Saunders Valves on ash sluicing lines in central power station.

BRANCH WAREHOUSES

Atlanta 2, Ga.	Kansas City 16, Mo.	Philadelphia 34, Pa.
Charlotte 1, N. C.	Long Beach 10, Cal.	Sacramento 14, Cal.
Chicago 9, Ill.	Los Angeles 13, Cal.	St. Louis 10, Mo.
Cleveland 14, O.	Milwaukee 3, Wis.	St. Paul, Minn.
Cranston 7, R. I.	Minneapolis 15, Minn.	San Francisco 7, Cal.
Fresno 1, Cal.	New York 17, N. Y.	Seattle 1, Wash.
Houston 1, Tex.	Oakland 7, Cal.	Spokane, Wash.

GRINNELL
WHENEVER PIPING IS INVOLVED

"KEX" Industrial Wiping TOWELS



...More Important Every Day to the

AMERICAN INDUSTRIAL SCENE

[Here—the Press Room, Chicago Sun and Times]

This important newspaper, as well as many other leading papers have found KEX Industrial Wiping Towels "made to order" for important wiping needs.

The reason—KEX Industrial Wiping Towels are produced especially for wiping. They are soft, with no harsh seams, no hidden buttons to mar delicate surfaces.

Every wiping towel is thoroughly cleaned and inspected before delivery to you. They come in neat, easily stored bundles that help you control distribution.

Follow the lead of industrial leaders who overlook no opportunity to keep operating costs down—and efficiency up.

Nothing to Buy—No Expensive Inventory—Just a Low Monthly Rental. The first month should show a decided saving on wiping costs.

For complete information, see your classified Telephone Directory for nearest KEX distributor, or write KEX NATIONAL SERVICE, 295 Fifth Avenue, New York 16, N. Y.

"KEX" NATIONAL SERVICE

REG. U.S. PAT. OFF.

"KEX" REG. U.S. PAT. OFF. NATIONAL SERVICE A CALLAWAY MILLS PRODUCT INDUSTRIAL WIPING CLOTHS

made of high-strength alloy steel forgings, the griplock teeth are machined and case-hardened for long wear. The eccentric, reversible jaw automatically grips round, square, or hexagon parts. American Die & Tool Co., Inc., 2nd & Buttonwood Sts., Reading, Pa.

•

DRUM HANDLER

Handling drums, barrels, or casks, Drum Master can be installed on any hydraulically operated fork truck. For straight loading or unloading operations, either boxcar or truck, a 2000-cap. fork truck is recommended. Drum handler can be removed in a few minutes, and the forks replaced for other operations. It has two control levers. Chine clamps are incorporated in addition to the regular tilting arms, which may be removed when the clamps are in use. When the arms are used, the chine clamps may be lifted out of the way. The handler picks drums up singly or in pairs, and sets them down where desired, handling tiered containers as well as single-decked. Weighing 500 pounds, it is made of heavy-gage channel stock, with welded construction. William Ehlers, 408 South Spring St., Los Angeles.

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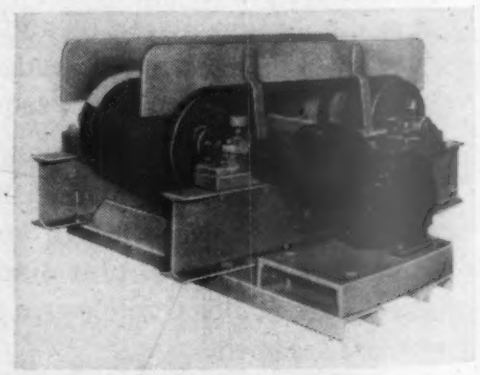


MAGNETIC SEPARATOR

Self-contained horizontal and inclined magnetic-pulley-type separators incorporate an Alnico magnetic Perma-Pulley, idler pulley, endless belt, and drive. They provide automatic removal of tramp iron from coal, plastics, ore, foods, chemicals, rubber, and similar materials, where protection of machinery or purification of product is desired. Can be installed at the discharge of chutes, hoppers, and conveyor belts, or can be fed by hand or by materials handling devices. Standard models are available with belts of any desired

Route this ad through your plant...

IT CAN SAVE YOU THOUSANDS OF MAINTENANCE DOLLARS

HOW YOU CAN HELP US TO HELP YOU

This message can help your company save money many ways. It can also be a source of information which will aid the work of every man and department in your company whose job is connected with preventing wire failures. After you've read it, please see that it reaches the right men. We'll appreciate it, and we think they will too.

You need no longer tolerate wire failures due to high ambient temperatures, overloads, deterioration caused by aging, oil, grease or corrosive fumes.

Because—a permanent insulation of heat and flame resistant impregnated asbestos gives Rockbestos A.V.C. wires and cables a long, trouble-free service life. This ageless insulation won't bake brittle, crack or flow under continuous 230°F. operating temperatures—and it has ample moisture resistance for conduit installations.

Rockbestos A.V.C. pays its way many times over by eliminating the need for frequent re-wiring caused by failure of ordinary insulation in hot spots.

Types AVA, AVB, AVL and AIA for control, lighting and power circuits in 600 to 5000 volt ratings. Write for recommendations and samples—or, if you prefer, the Rockbestos engineer nearest you will call.

ROCKBESTOS PRODUCTS CORP., 621 NICOLL ST., NEW HAVEN 4, CONN.

NEW YORK BUFFALO CLEVELAND DETROIT CHICAGO
PITTSBURGH ST. LOUIS LOS ANGELES OAKLAND, CALIF.

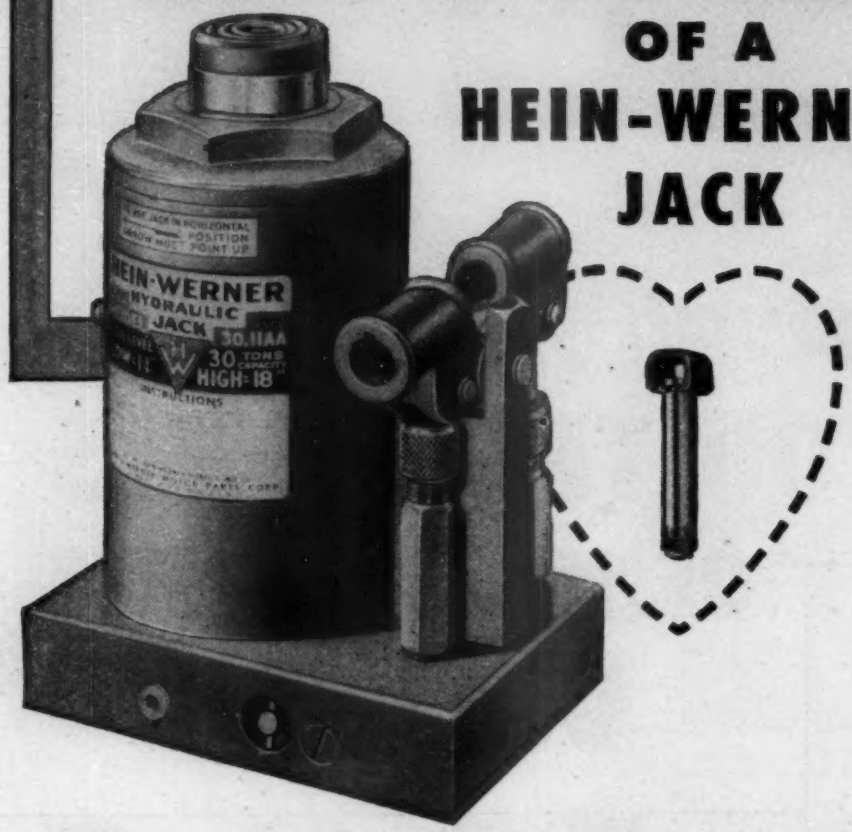
A few of the 125 different permanently insulated Rockbestos wires and cables designed to protect operations and reduce maintenance in control, lighting and power circuits. From left to right:

Type AVA 600 Volt Rockbestos A.V.C. Power Cable*
Type AVA 600 Volt Rockbestos A.V.C. Boiler Room Wire
Type AVB 600 Volt Rockbestos A.V.C. Switchboard Wire

*Other single and multi-conductor cables up to 5000 volt rating—also with lead sheath, armor or lead sheath and armor coverings.

ROCKBESTOS A.V.C. — ***The Wire with Permanent Insulation***

BETTER PERFORMANCE STARTS AT THE HEART OF A HEIN-WERNER JACK

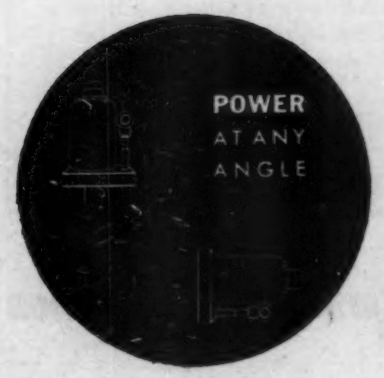


The "heart" of a Hein-Werner Hydraulic Jack is its Heinite Piston, proven by actual tests to withstand ten times the wear of conventional cups or packings. Completely engineered and manufactured in our own plant, the exclusive Heinite Piston is your guarantee of maximum operating efficiency in every Hein-Werner Hydraulic Jack.

FOR APPLICATIONS IN YOUR PLANT REQUIRING UP TO 100 TONS PRESSURE!

Industrial plants have found many time and labor-saving uses for Hein-Werner Hydraulic Jacks. For maintenance, conversion or production line operations, these hydraulic jacks are efficient for pressing gears, pinions or bushings—or for helping to shift heavy machinery, move heavy stock, or other load-lifting operations up to 100 tons. Every Hein-Werner Jack is tested at 1½ times its rated capacity.

Made in models of 1½, 3, 5, 8, 12, 20, 30, 50 and 100 tons capacity. See your industrial supply distributor or write us.



Hein-Werner
HYDRAULIC JACKS

HEIN-WERNER CORPORATION
WAUKESHA • WISCONSIN

length, in widths ranging from 12 to 60 inches. Perma-Pulley diameters range from 12 to 30 inches. Dings Magnetic Separator Co., 4740 West McGeogh Ave., Milwaukee 14.

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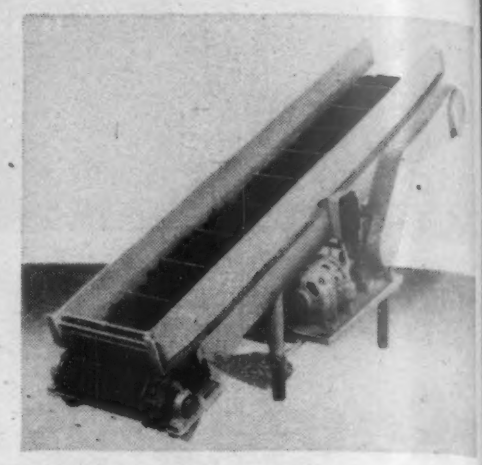

PARTS CONVEYOR

Patented steel link type conveyor belt is featured in heavy-duty conveyor for handling sharp metal parts or heated material. The standard model is 8 feet 6 inches long, with 16-in. wide belt. Loading height is variable from 9 to 24 inches, and discharge height from 70 to 33 inches. Longer or shorter units with a range of belt widths can be furnished. The standard belt is constructed of 16-gage steel stampings spaced to provide a mesh measuring 9/16 inch square. Other sizes can be supplied. The standard unit is driven by a ¼-hp. gear-head motor, providing a belt surface speed of 40 f.p.m. Other speeds and variable speed drives are available. The belt is carried on antifriction, self-aligning bearings. Howard Eng. & Mfg. Co., 2235 Buck St., Cincinnati 14.

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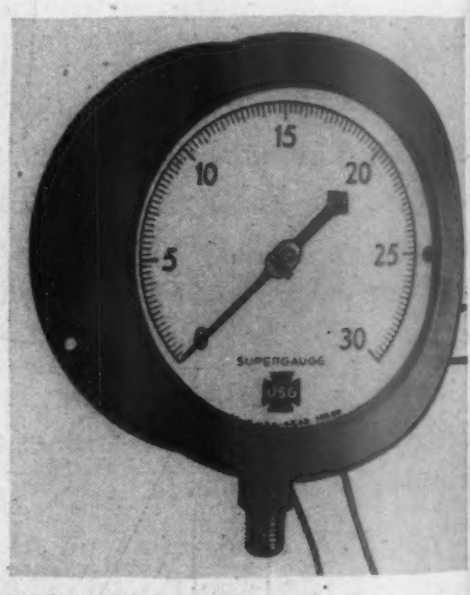
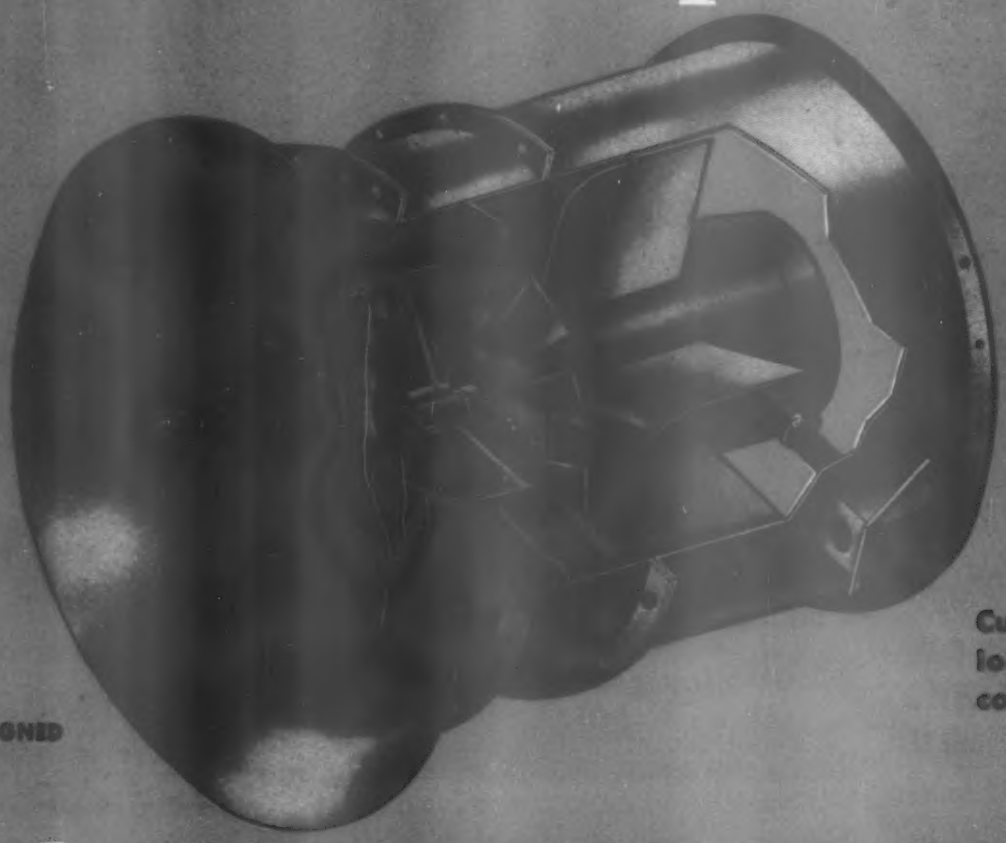


PRESSURE SWITCH

Types V and VI pressure switch feature a switching differential of 3 per cent of the full scale; also an electric capacity of 10 amperes at 125 volts a.c. over the entire range from 30-in. vacuum to 10,000-lb. pressure. Although both instruments are of similar functional design, Type VI has an extra Bourdon spring connected internally to the alarm spring to activate an indicator. This is said to permit an accurate indication of the pressure being controlled, while remaining independent of the setting of the

NOW AVAILABLE

a Fan of outstanding Engineering, Construction and Performance Superiority



Cutout drawing showing location of motor and compact fan construction

ROLLER DESIGNED

the "SERIES 1000"

JOY AXIVANE FAN

A stock line of Vaneaxial Fans with an unequalled range in volume and sizes.

Volumes up to 100,000 C.F.M.
Pressures up to 9.6" W.G.
Housing diameters 18" to 60"

nd the added advantage of on-the-job ADJUS-ABLE BLADES to meet changing volume and pres-re demands. Write for descriptive Bulletin.

WBD 1-1455

Consult a Joy Engineer

OY MANUFACTURING COMPANY

ENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

Reduce Production Headaches!

. . . use the right Cutting Fluid!

Questions concerning use and application of cutting fluids are the cause of many shop headaches. When critical parts have to be rejected and finishes are bad and tools have to be sharpened frequently, jobs go sour and schedules aren't met, cutting oils may be at the bottom of it. D. A. Stuart Oil Co. representatives have had plenty of experience in straightening out such situations, developing the correct application, improving production —curing the headaches. Let them prescribe for you.

Here's an oil . . .

THAT WILL HELP YOU— D. A. STUART'S KLEENKUT WATER-MIXED CUTTING OIL

Stuart's Controlled KleenKut water-mixed cutting oil has a long established, consistent record of excellent performance on the majority of metal-cutting operations. On drilling, reaming, sawing, tough turning, machining cast iron, cutting bolt threads, planing and milling, and other jobs where cooling qualities or cleanability are dominant requirements, KLEENKUT has meant machining excellence since 1912 . . . Carries off heat rapidly . . . Increases tool life . . . Improves finishes . . . Flushes chips and contaminants from the work area . . . Reduces power consumption . . . Contains only top-quality ingredients . . . Chemically stable . . . Free from objectionable odor . . . Simple to clean from parts or machines . . . Mixes freely with water. *ANOTHER TIME-TESTED STUART PRODUCT!*

STUART *oil engineering goes with every barrel*

D. A. Stuart Oil Co.

2727-37 SOUTH TROY STREET, CHICAGO 23, ILL.

electric contacts. The switches are suitable for measuring either temperature or pressure, and are available in a range of sizes and pressures. United States Gauge Div., American Machine & Metals, Inc., Sellersville, Pa.

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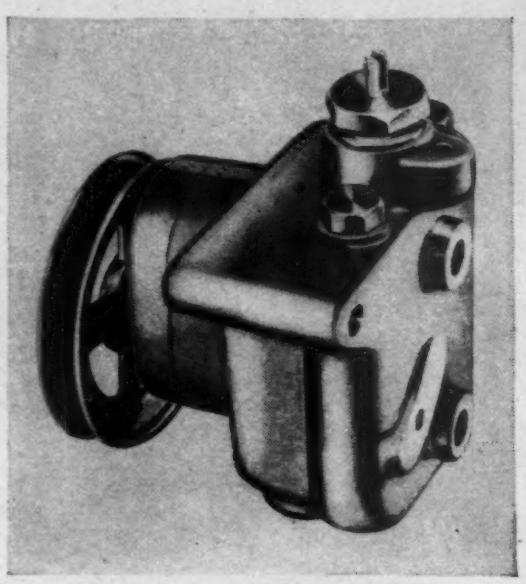

HYDRAULIC POWER UNIT

Ten-Ton-Tony is the name of a small-sized hydraulic unit for arbor presses; hydraulic clamping vises; forming, straightening, and bending devices; light materials handling units, and other machinery applications where push, pull, or lift are functional requirements. The unit measures 6x7x9 inches over-all. It has a 3-g.p.m. oil capacity at 1200 r.p.m. at 1000 p.s.i., or 4½ g.p.m. at 1800 r.p.m. at 1000 p.s.i. It requires approximately 2½ horsepower to operate at 1200 r.p.m. The unit consists of a gear pump with hardened and ground gears running in bronze bearings; a valve housing protecting the check valves; and the 4-way control valve which permits use of a double-acting cylinder, hydraulically actuated in both directions. Hydro-Power Div., The Hydraulic Press Mfg. Co., Springfield, Ohio.

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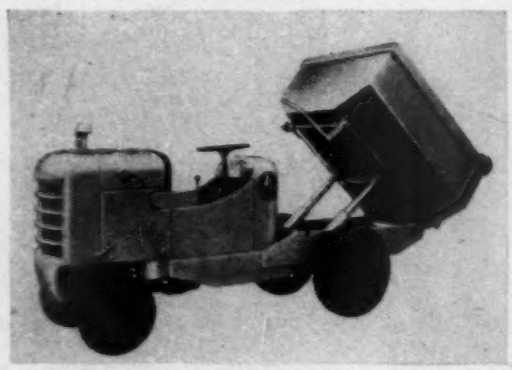
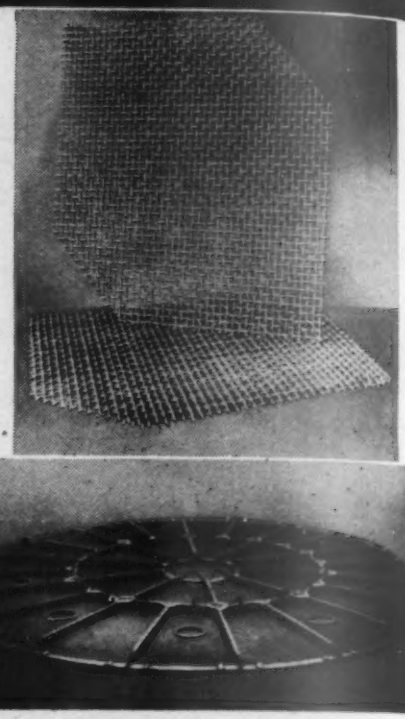


HAULING TRUCK

Gasoline - engine - powered, 4 - wheel, pneumatic-tired hauling unit, called Payloader Buggy, has a 2-cu.-yd. capacity, and hydraulically dumped body. Moves bulk materials in and around plants and yards over long hauls. Built as a companion to the Payloader Shovel, it has similar capacity, size, speeds, and operation, and all main parts are interchangeable. The truck is built low, with a short wheel base, and rear-wheel steering so it can operate in congested low headroom areas. Over-all height is

See Cambridge first when you need WIRE CLOTH or METALLIC SCREEN



Woven wire assemblies, specially fabricated by Cambridge, for screening and filtration.

Call in a Cambridge field engineer to discuss the proper filter cloth or screen for your filtering, screening, washing, or sorting operations. Let us tell you how Cambridge filter cloth and screens are specially woven for specific installations—specially woven from any metal or alloy to any mesh or weave.

Or, for information on the entire Cambridge line, write for your *FREE* copy of this 73 page illustrated booklet.

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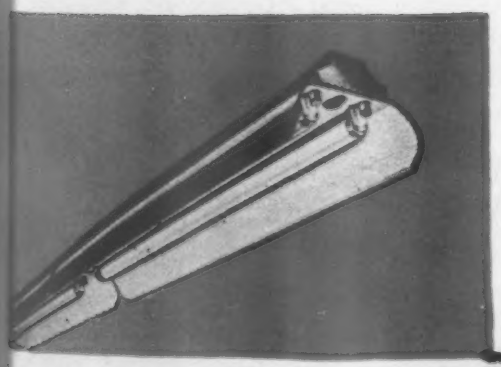
OPTICALLY ENGINEERED

for any industrial application

Whether your plant has high ceilings or low ceilings, hard-to-light corners, light-absorbing floors and walls... whatever your plant lighting problems, you can solve them with Day-Brite Fluorescent Lighting Fixtures. They distribute glare-free light evenly on the working plane, are rigidly constructed of heavy gauge steel, and engineered to withstand shock and vibration. Day-Brite Fixtures are made to last.

The **DAY-LINE** heavy-duty industrial fluorescent fixture with porcelain-enameled steel reflectors. Designed for two and three 40-watt and two 100-watt lamps... unit or continuous installations. U. S. Patent Nos. 2317434, D-135375 and D-133458.



Day-Brite Lighting, Inc., 5441 Bulwer Avenue, St. Louis 7, Mo.
Nationally distributed through leading electrical supply houses.

In Canada: address all inquiries to Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

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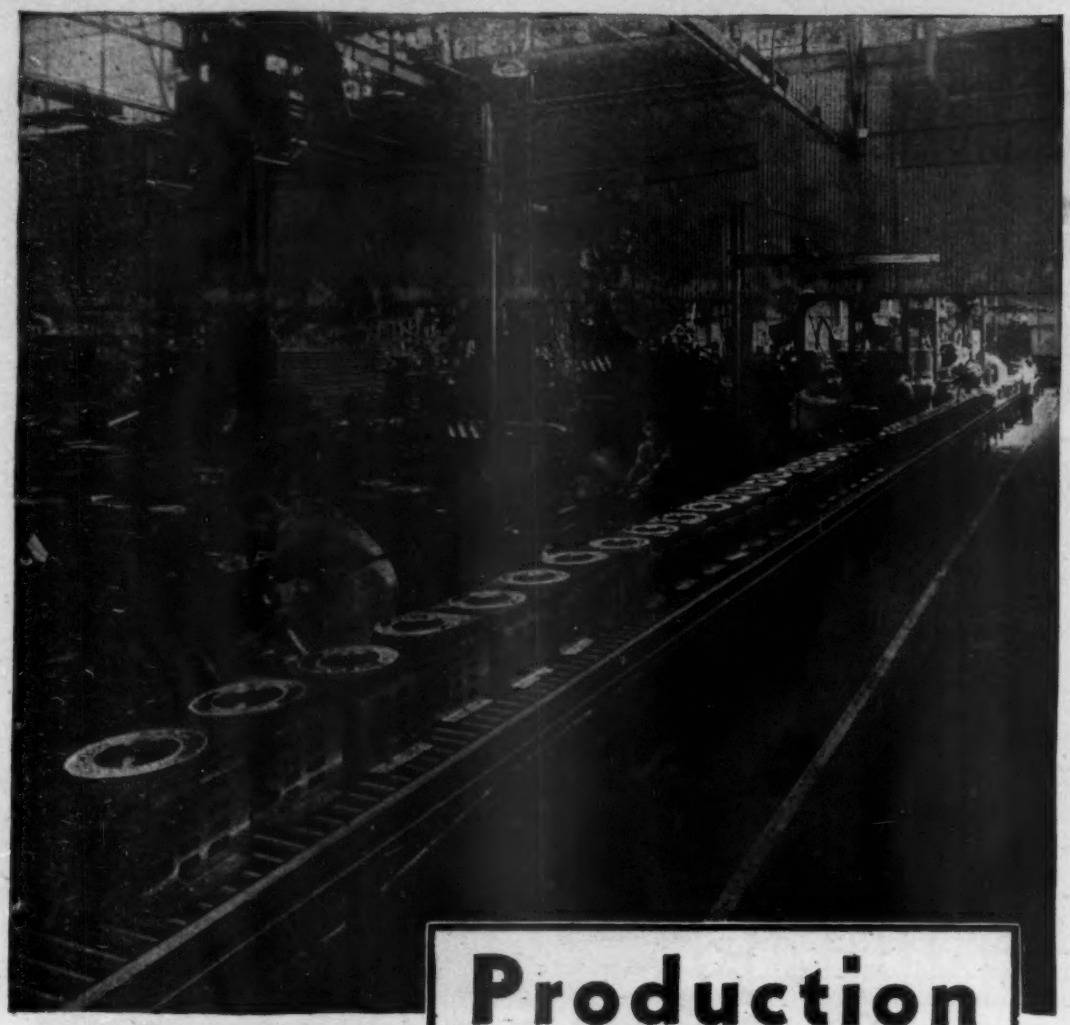
IT'S EASY TO SEE WHEN IT'S

DAY-BRITE Lighting



Logan Roller Conveyor puts machining operations "on a line." 500 lb. journal box cast n a. e ea oved from station to station by a gentle push. Castings are removed at rious machines and replaced on conveyor by small cranes.

Production machinery...

not just auxiliary equipment

"A GREAT IMPROVEMENT" on wheelbarrow and push truck—was the first industrial conveyor. Yet it was only transportation.

Today, well-planned material handling equipment is regarded as basic production machinery. In fact, Logan Conveyors have become such an integral part of manufacturing, processing, packing, and shipping as to be considered indispensable in thousands of plants.

Conveyors provide "flow," a continuous movement of material directly from process to process, at convenient working heights, and at big savings in manpower, time and floor space.

Wherever you are, whatever you make, the chances are that Logan equipment can effect cost savings and efficiencies at two, three, or more of your plant operations.

Logan Conveyors

LOGAN CO., INC., 510 CABEL ST. LOUISVILLE, KY.

5 feet 8 inches. Large wheels with pneumatic tires permit operation on paved or unpaved surfaces, and it has hydraulic brakes and full visibility. Two forward and two reverse speeds are provided. The Frank G. Hough Co., 802-X Sunnyside Ave., Libertyville, Ill.

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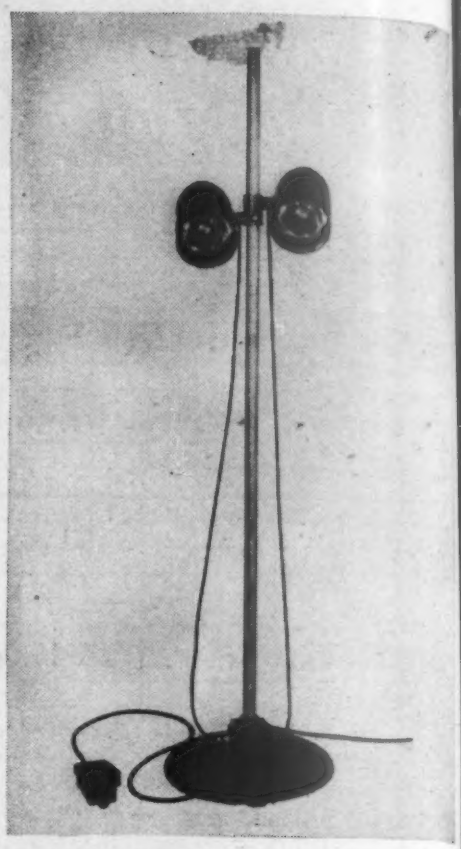


SPOTLIGHT

Welding, cutting, or brazing work can be illuminated by spotlight using a 6-volt, sealed-beam lamp operated from a transformer built in the housing. It casts a small-diameter circle of light from 2500-foot candle brilliance when placed 3 feet from the work, to 1000-foot candles when 6 feet away. Weighing 5 pounds, the assembly can be mounted at any angle on a convenient 1-in. pipe, or on its own stand by a clamp and positive-action spring-loaded swivel joint. Power requirement is 30 watts at 115 volts, 60 cycles. Available as single units with built-in transformer and clamp, or in a combination of two spotlights and a 6-ft. pipe stand with built-in receptacles, a foot-operated switch, and power cord. Westinghouse Electric Corp., P.O. Box 868, Pittsburgh.

•

ENCLOSED-BELT CONVEYOR

Continuous, enclosed-belt conveyor-elevator, called "Zipper," is suitable for handling bulky foods, dry chemicals, coal, or any granular, flaky, pulverized,

TO PUT YOUR BUILDING UP

fast

A building of structural steel with Plastipitch Protected Metal roof and sidewalls can be erected more rapidly than one of masonry or brick

TO PUT IT UP

economically

A building of Koppers Plastipitch is basically more economical, and prices have not risen in the same proportion as many other building materials

USE KOPPERS

PLASTIPITCH*

PROTECTED METAL

TO KEEP IT

flexible

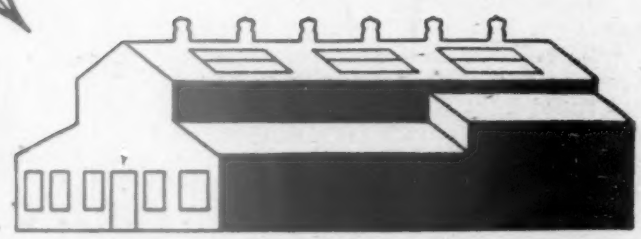
FOR PROCESS CHANGES

A building erected with Plastipitch can be altered, enlarged, or taken down and moved to a new location, if processes change

TO PUT IT UP

permanently

With the Koppers Plastipitch method of protecting steel sheets, they are safeguarded from weather, salt-air, corrosive industrial atmospheres, etc.



Plastipitch Protected Metal is backed by six years of industrial applications, and by thirty years of Koppers experience in the manufacture of coal tar pitch for roofing industrial buildings. Send for this manual which tells recommended uses, methods of erection, and the help you can get from Koppers on detailing special shapes, gutters, downspouts, flashings and other accessories for a Plastipitch building.

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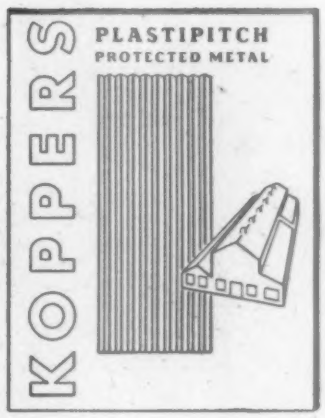

KOPPERS COMPANY, INC., Pittsburgh 19, Pa.

Please send me free copy of your manual on Plastipitch Protected Metal.

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TITLE _____

FIRM NAME _____

ADDRESS _____

KOPPERS COMPANY, INC. K KOPPERS **PITTSBURGH 19, PA.**

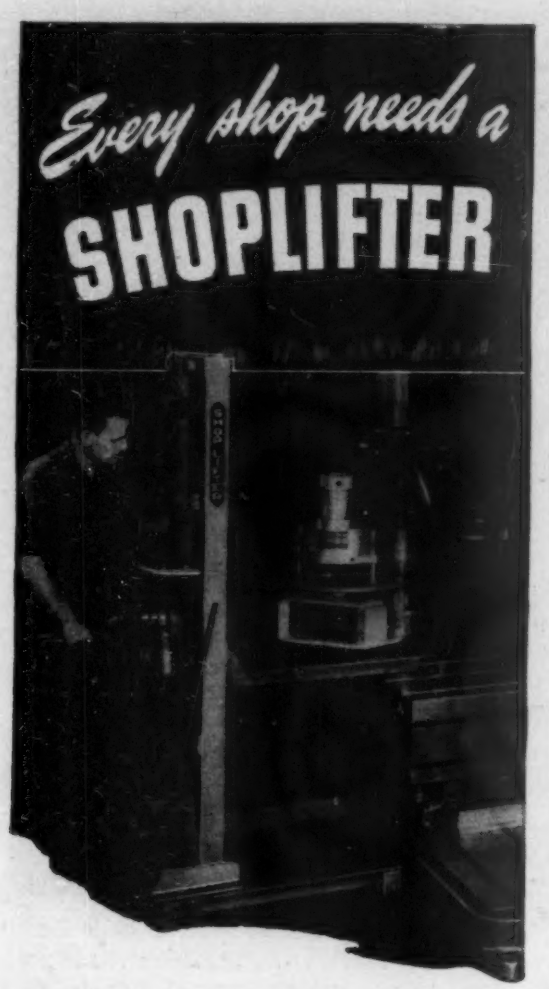
KOPPERS SUPPLIES MORE KINDS OF WATER-REPELLENT, CORROSION-RESISTANT COATINGS FOR MORE PURPOSES THAN ANY OTHER COMPANY

(1) Coal-tar pitch roofing

(2) Bitumastic Protective Coatings for pipe, structural steel

and other metal, concrete, masonry and insulation. (3) Plastipitch Protected Metal for roofing and siding of industrial and farm buildings

(4) Coal-tar waterproofing and dampproofing.



● One man can safely handle heavy loads up to 500 pounds with the aid of an Economy SHOPLIFTER. It's the ideal lifter for handling dies and heavy shop equipment, for use as an adjustable work table, loading street trucks, stacking drums, boxes and many other products.

The SHOPLIFTER is made as compact as possible so that it can be used where space is at a premium. Clears ordinary doorways with ease, can be taken down narrow aisles and along side other machinery. Shop men like the Economy SHOPLIFTER because back-breaking manual lifting is eliminated, accidents are greatly reduced, and valuable production time is saved.

24 inch square steel plate platform has lift of 54 inches above floor. Overall height 72 inches, capacity 500 pounds. Price of complete machine $157.50 f.o.b. Chicago freight prepaid anywhere in the U.S. Foot operated floor lock $10.00 extra. Heavier lifter models also available, capacities up to 5000 pounds.

Write for details

ECONOMY ENGINEERING COMPANY
2663 West Van Buren Street
CHICAGO 12, ILLINOIS

or small lump materials. The load is conveyed and elevated in any direction, in a solid mass, entirely enclosed within the belt without spillage, breakage, or contamination of the product. At discharge point, the belt opens automatically for emptying and to permit cleaning. Stephens-Adamson Mfg. Co., Aurora, Ill.

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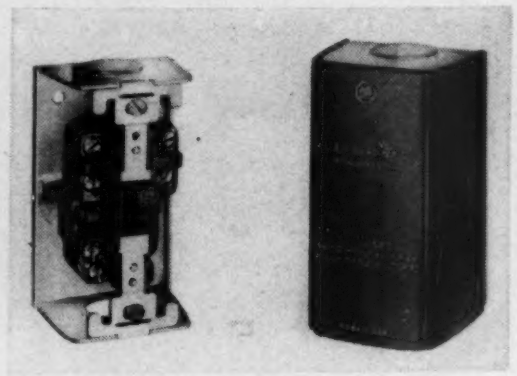

STARTING SWITCH

Bulletin 600 manually operated snap switch is for starting motors of 1 horsepower or less. Has an overload device which operates on the soldered ratchet principle. The switch cannot be held closed under sustained overload, maker says, but can be reset with the regular switch lever after the overload is cleared. Has a molded plastic cover, but can be furnished without enclosure for mounting in a standard switchbox or machine base. Different enclosures are available to meet requirements. Allen-Bradley Co., 1311 South 1st St., Milwaukee.

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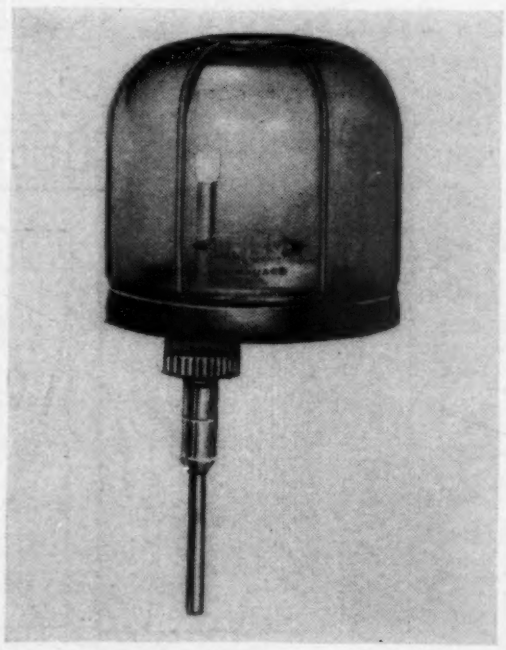

PLASTIC OILER

Unbreakable, automatic oiler is intended to replace ordinary oil cups in places where space between oil hole and machinery is limited. The rod rides on a rotating shaft, and any vibration or vertical movement releases oil from the plastic bottle to lubricate solid, wick, or waste-packed bearings. As the bearing heats, thermal action forces oil on the bearing at a greater rate. Feed stops when shaft is not in motion. Maker states that oil supply is always visible in the plastic reservoir; there are no gaskets to leak; metal parts are cadmium-plated;

FOR THE UTMOST IN RUST PREVENTION

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GALVANIZED PRODUCTS
PROTECTED BY GENUINE
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AMERICAN HOT-DIP GALVANIZERS ASSOCIATION INC.

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COMMERCIAL METALS TREATING, INC., TOLEDO

PENNSYLVANIA
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AMERICAN TINNING & GALVANIZING CO., ERIE
HANLON-GREGORY GALVANIZING CO., PITTSBURGH
OLIVER IRON & STEEL CORP., PITTSBURGH
PENN GALVANIZING COMPANY, PHILADELPHIA

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M. M. HEDGES MFG. COMPANY, INC., CHATTANOOGA

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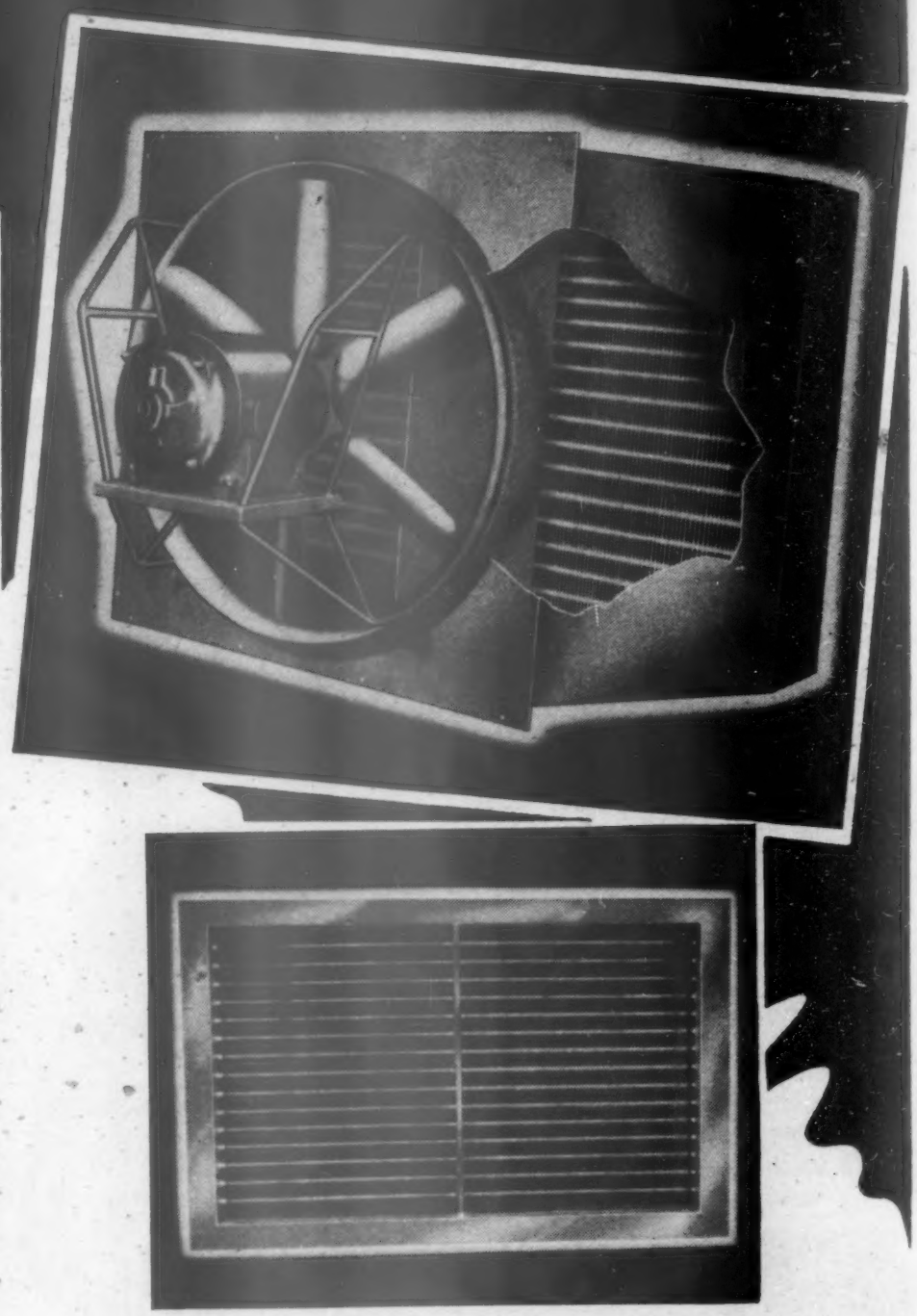
ACME GALVANIZING, INC., MILWAUKEE

hot-dip GALVANIZING

NEW!

REPLACE EXHAUSTED AIR WITH TEMPERED FRESH OUTSIDE AIR



Does a gale of chilly air sweep into your plant when a door is opened? Can you locate cracks and crevices by the flow of cold outside air near them? When your exhaust system is at full operation does it seem to function with less than normal efficiency?

Even if you have not noticed such signs, if you operate an exhaust system without compensating for the air it removes you are "starving" your exhaust fans. Lack of air behind them is as bad as excessive pressure in front of them. It gives the same result—inefficient operation. In addition, it brings in cold air, producing cold spots.

The new Hartzell Intake Air Unit overcomes these troubles in one compact, simple package. It introduces the air needed to balance the exhaust system. It tempers the incoming air to the temperature you select—filters it, too, if you wish. It therefore increases ventilation efficiency and at the same time improves working conditions.

It comes as a complete, self-contained unit, easy to install, and operates with practically no attention. Provision is made for air filters; frame and filters are provided when desired. Automatic and manual controls of various types are also available.

Bulletin 2101, just off the press, gives details of this new development. It's free on request.

The Hartzell core, properly installed and operated, will not freeze.

HARTZELL PROPELLER FAN CO.

DIVISION OF CASTLE HILLS CORPORATION

PIQUA, OHIO

PROPELLER-TYPE FANS AND BLOWERS • ROOF VENTILATORS • UNIT HEATERS • ENGINEERING OFFICES IN PRINCIPAL CITIES

NO TANGLES, KINKS or BREAKS

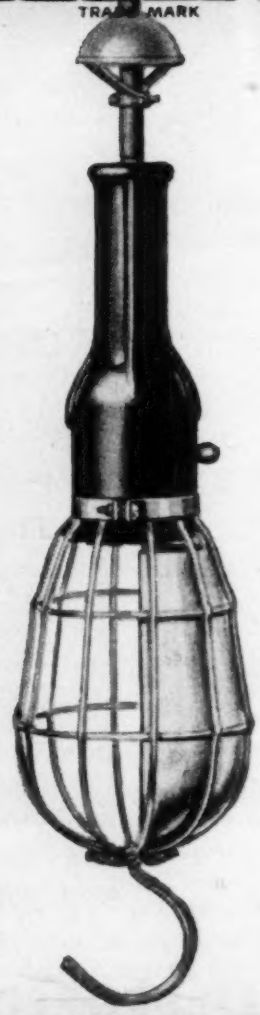
In Light Cable

NEOPRENE JACKETED CABLE for longer wear

WITH PORTABLE TYPE

APPLETON REELITE

TRADE MARK



For car-loading, machine-inspection, stock-keeping, maintenance-work—in any out-of-the-way spot where good light is often important, on short notice—the Appleton Portable Reelite is the safe, complete answer.

Sturdy extension cord stays reeled up out of the way; then, when light is needed, it unreels or re-reels against spring tension to exact length required, like a window shade. Held in place while in use by a ratchet stop.

Cable is jacketed with genuine DuPont Neoprene . . . tough, long-wearing, and resistant to oil, heat, acid fumes and other conditions which cause ordinary extension cord to fail.

Sold Through Electrical Wholesalers

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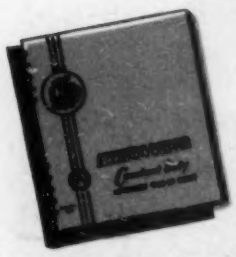
1715 Wellington Avenue • Chicago 13, Illinois

14 Branch Offices and 7 Resident Representatives in All Principal Markets



SEND TODAY! For 50-page Bulletin 504, describing the entire line of Appleton Portable Reelites . . . large Constant Duty types, as well as special reels for power tools, air and fluid lines, or see Sweet's File page 2a/22.

APPLETON

CONDUIT FITTINGS • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

and oiler is removable for filling. Made in 1-, 2-, and 4-oz. capacities, the oiler is installed by removing old cup and screwing in the ⅛-in. pipethread adapter furnished with each oiler. Trico Fuse Mfg. Co., 2948 No. 5th St., Milwaukee 12.

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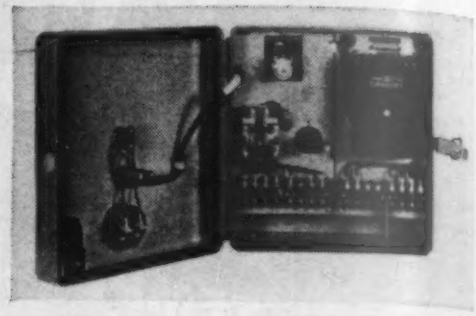

COMBUSTION CONTROL

Photo-electric combustion control system for oil burners is composed of master control, photo-tube, and electrode units. The system is designed to shut off the flow of fuel to an oil burner if the oil fails to ignite, or if the flame is extinguished after successfully igniting. On gas-electric ignition systems, it prevents fuel from flowing if the gas pilot does not ignite. The system allows the burner motor to operate for a definite period after shutdown or combustion failure in order to purge the nozzle or cup of unburned fuel. The system is locked against further operation after a failure to start until manually reset. A complete starting sequence is assured after shutdown of the burner because the oil valve does not open until the program switch re-cycles. Control Div., General Electric Co., Schenectady 5.

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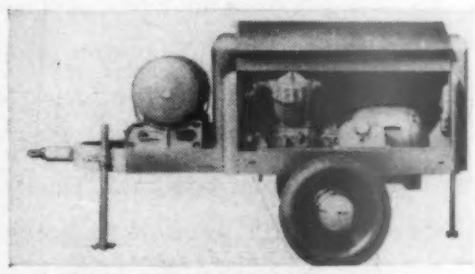

PORTABLE COMPRESSORS

Electric portable compressors, in 60-, 105-, 160-, 210-, and 315-c.f.m. capacities, is available in skid, 2-wheel trailer, and 4-wheel trailer mountings. Known as "Air Chief Electrics," they are of 2-stage construction, with intercooler and safety valve. Units are direct driven from 1200 r.p.m., 220/440-volt a.c. motors of squirrel-cage, horizontal type. Motor starters are full-voltage, a.c. magnetic non-reversing, standard sheet-steel NEMA Type 1, 3-phase, 60-cycle, with heaters for motor protection. Davey Compressor Co., Kent, Ohio.

•

CORROSION-RESISTANT COATINGS

Two types of corrosion-resistant Zincilate coatings air-dry without baking. Coatings of enamel, paint, or wrinkle finishes may be applied over them after five minutes of air drying, and both coatings can be baked at the same time. Suitable for application by dipping

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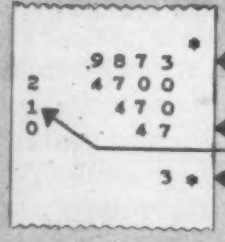

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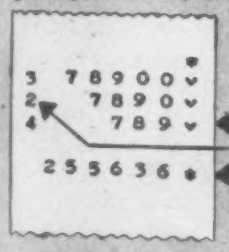

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T-701—4 Wheel Steer
4 Ton Capacity

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Plant: Clifton, N. J.
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30 CHURCH ST., NEW YORK 7, N. Y.

Users Save $10.08 per Wheel or Caster with

AEROL EQUIPMENT

Corrosion-resistant, **spark-proof Aerol Aluminum Alloy Wheels have heavy-duty, solid rubber tires.**

Silent, smooth-rolling **Aerol Aluminum Alloy Casters are available in swivel or rigid type.**

High Performance Low Maintenance

The average wheel or caster needs lubrication every month of its estimated six-year operating life, at a cost to the user of $10.08. Aerol Wheels and Casters are furnished exclusively with high precision Timken Tapered Roller Bearings that are factory-lubricated and sealed for their normal life. Think what this means in terms of four-wheel equipment—*Aerol not only saves you maintenance costs, but gives you advanced design and easier operation as well.*

Immediate Delivery!

IMPORTANT NOTICE!

If any of your Aerol Materials Handling Equipment ever needs replacing, merely ship it to us and we'll replace it at one-half the current list price.

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All-aluminum wheels . . . rubber-tired wheels
pneumatic wheels . . . rigid casters . . . swivel casters
all-aluminum Universal hand trucks

spraying, brushing, or roller coating, with finishing equipment. It can be used for maintenance and repair of existing structures. Industrial Metal Protectives, Inc., Dayton 2, Ohio.

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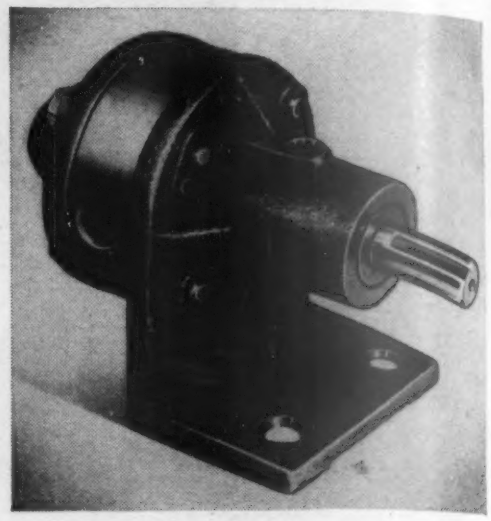

ROTARY PUMP

Series C-175 rotary pump is claimed to offer positive displacement, high volumetric efficiency, and low power requirements. Ordinary wear does not reduce the pump capacity or pressure, and quiet operation at standard electric motor speeds eliminates the need for belts and pulleys. The standard pump handles lubricating oils, hydraulic oils, kerosene, fuel oils, and coolants, with capacities from ½ to 4 g.p.m. at 125-p.s.i. working pressure. Can be run in either direction without alteration. Available in foot, flange, and sump mounts. Pumps for higher pressures, other fluids, or special operating conditions may be obtained. Ellipse Corp., 4140 North Kedzie Ave., Chicago 18.

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A.C. ARC WELDER

Named Arcrite, a.c. welder, with current range of 25 to 250 amps., has a current control that is continuously adjustable by means of a handwheel. Transformer insulation is all glass and mica, and windings consist of extra-heavy rectangular glass-covered wire. Measuring 18x18x37 inches, the welder weighs 300 pounds. Accessories include helmet, welding cables, power cables, electrode holder, and ground clamp. The machine will weld light sheet metal or heavy

How to INCREASE BOILER RATINGS with your present furnace and stack

Coppus-Dennis FANMIX Burners Give You More Heat with No Other Major Change in Equipment

Coppus-Dennis **FANMIX** Burners give you *perfect* mechanical mixing of fuel and air *at the burner outlet . . . instantaneous* ignition close to the burner . . . and *complete* combustion *without visible flame* when burning natural gas. No other burner combines these three advantages.

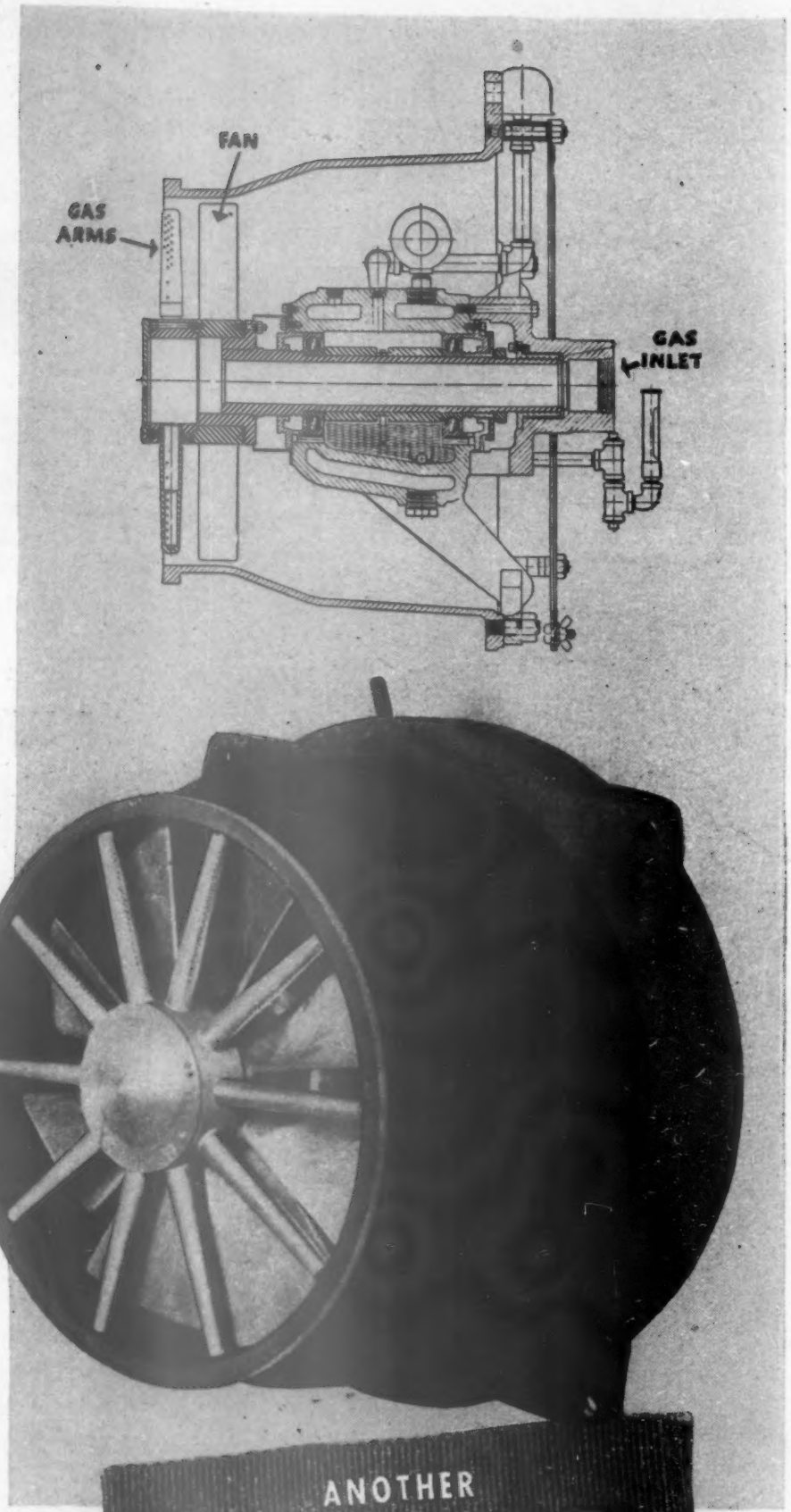
Because **FANMIX** delivers the *right* mixture of fuel and air *without blow-torch action*, all of your furnace space is used for combustion . . . *none for mixing*. That's why your present furnace can release more heat . . . why new installations can get more heat out of smaller furnace space.

Because **FANMIX** can be guaranteed to secure complete combustion of natural gas *with less than 5% excess air*, you get uniform "radiant heat" *without drifting hot spots*. That's why a FANMIX-fired furnace seldom varies in temperature more than 5% over its entire area.

WRITE FOR ALL THE FACTS

When you see in Bulletin 410–5 how fuel escaping from orifices in rotating driver arms rotates the fan to draw the correct proportion of air into the path of the fuel at right angles . . . how **FANMIX** creates its own forced draft, reduces stack requirements, prevents cracking of "wet" gas . . . how two FANMIX types handle either gas or oil or any combination of both — you'll understand why **FANMIX** Burners have such wide acceptance in oil refineries and power plants.

Send for the Coppus-Dennis **FANMIX** Bulletin 410–5. Coppus Engineering Corporation, Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, and REFINERY CATALOG.



ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

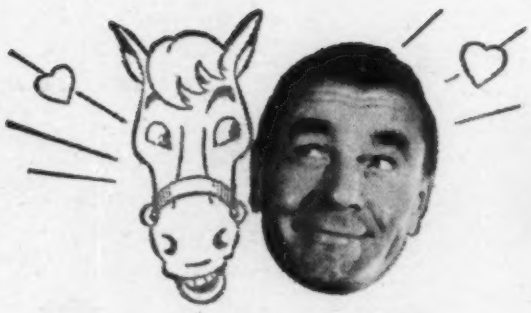
COPPUS ENGINEERING CORP.
103 Park Ave., Worcester 2, Mass.
Please send Bulletin 410–5 to:

Name .....

Company .....

Address .....

Bucking up against RISING COSTS?



...here's a sure way to BREAK 'EM!

To tame high-and-mighty maintenance costs which stubbornly refuse to be controlled, look to better, quicker methods of sanitation.

By using proper cleaning materials, scientifically designed by West, you plug profit leaks at many sources. The initial cost of the proper sanitation product is trifling compared to the *time* and *effort* expended in using it. *Quicker-acting* West products for floors, washrooms and for personal protection save money because they save time.

They are formulated for easy application plus maximum efficiency and long-lasting effectiveness. Really a practical answer for helping industry solve a vital problem — maximum health protection at low cost.

West products can be profitably applied to your business. Why not consult one of nearly 500 trained West representatives throughout the United States and Canada. His cost-cutting suggestions will prove invaluable.

PRODUCTS THAT PROMOTE SANITATION

WEST DISINFECTING Company

42-16 West Street, Long Island City 1, N.Y.

CLEANSING DISINFECTANTS · INSECTICIDES · KOTEX VENDING MACHINES
PAPER TOWELS · AUTOMATIC DEODORIZING APPLIANCES · LIQUID SOAPS

plates requiring deep penetration. Mellaphone Corp., Rochester, N. Y.

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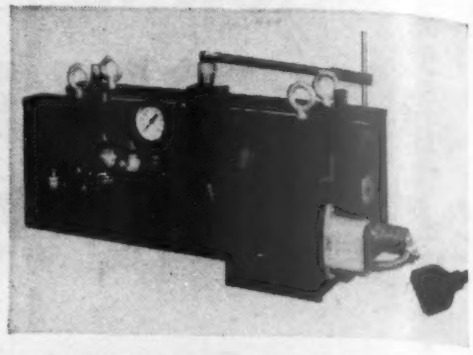

ELECTRIC CABLE VULCANIZERS

Rubber cable vulcanizers permit on-the-job repairs of bad spots in jacket insulation, thereby eliminating scrapping lengths of otherwise good cable. Electrically heated, two types are available. One applies heat, thermostatically controlled, directly to its molds; the other heats its molds by automatically controlled steam pressure. Mines Equipment Co., Dept. 8, 4215 Clayton Ave., St. Louis 10.

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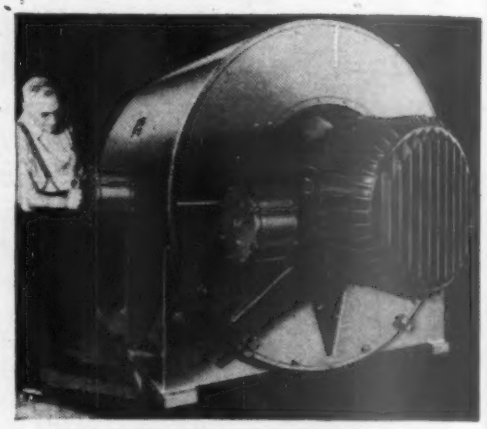

FAN-COOLED MOTOR

Redesigned, totally enclosed, fan-cooled, wound-rotor motors are built with a tube-type air-to-air heat exchanger. Use of the exchanger permits a reduction in size compared to older, totally enclosed, fan-cooled designs. The motors can be built with stainless steel ventilating tubes, fans, and end plates, and cast-iron terminal boxes and collector ring enclosures. Allis-Chalmers Mfg. Co., Milwaukee.

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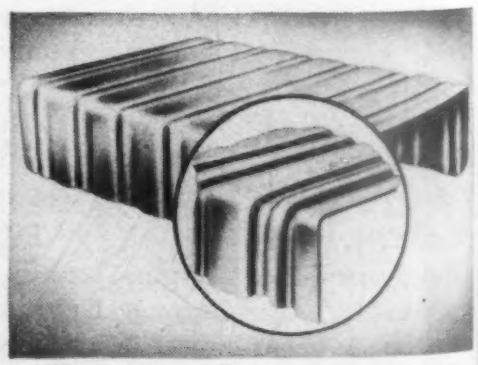

ALUMINUM SKID PLATFORMS

Double-corrugated one-piece skid platforms, made of aluminum, consist of two recessed corrugations joined by a raised center rib, which acts as a built-in knee brace. Manufacturer states that this center rib strengthens the legs, reduces the danger of their being bent outward by

Why the Barrett* SPECIFICATION* Roof

is the toughest, longest-lasting, best-value built-up roof that can be made

1. **BARRETT SPECIFICATION* PITCH AND FELT**
2. *Barrett Application Methods*
3. *The Gravel or Slag Armored Surface*
4. *The Barrett Approved Roofer*

The superiority of the Barrett Specification* Roof is due to the combination of highest-quality roofing materials, the protective surface of gravel or slag, and scientifically standardized application techniques used by Barrett Approved Roofers. The result is a roof so good that it can be bonded against repair and maintenance expense for periods up to 20 years—a roof so good that it regularly outlasts the bonded period by many years.

Barrett* Specification* Roofs

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.
36th St. & Gray's Ferry Ave.
Philadelphia 46, Pa.
2800 So. Sacramento Avenue
Chicago 23, Ill.
Birmingham, Alabama
In Canada: The Barrett Company, Ltd.
5551 St. Hubert St., Montreal, P. Q.

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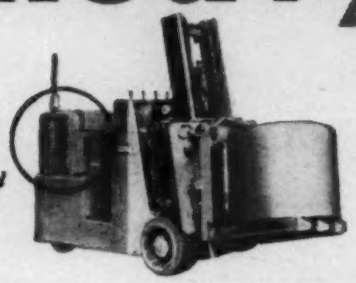
BARRETT SPECIFICATION* Pitch is the *only* pitch that measures up to the high standards of the Barrett Specification* Roof. It is refined from top-quality coal-tar, and recommended application temperatures have been carefully developed. Used according to Barrett specifications . . .

IT PROVIDES the life-prolonging oils that are virtually immune to climatic variations. Barrett Specification* Pitch is actually *preserved* by water, and possesses creosote properties that retard fermentation and the development of fungi.

COMPANION TO Barrett Specification* Pitch is Barrett Specification* Felt—the *only* felt good enough for a Barrett Specification* Roof. It is made from carefully selected and fabricated stock and special coal-tar saturant to meet rigid manufacturing standards.

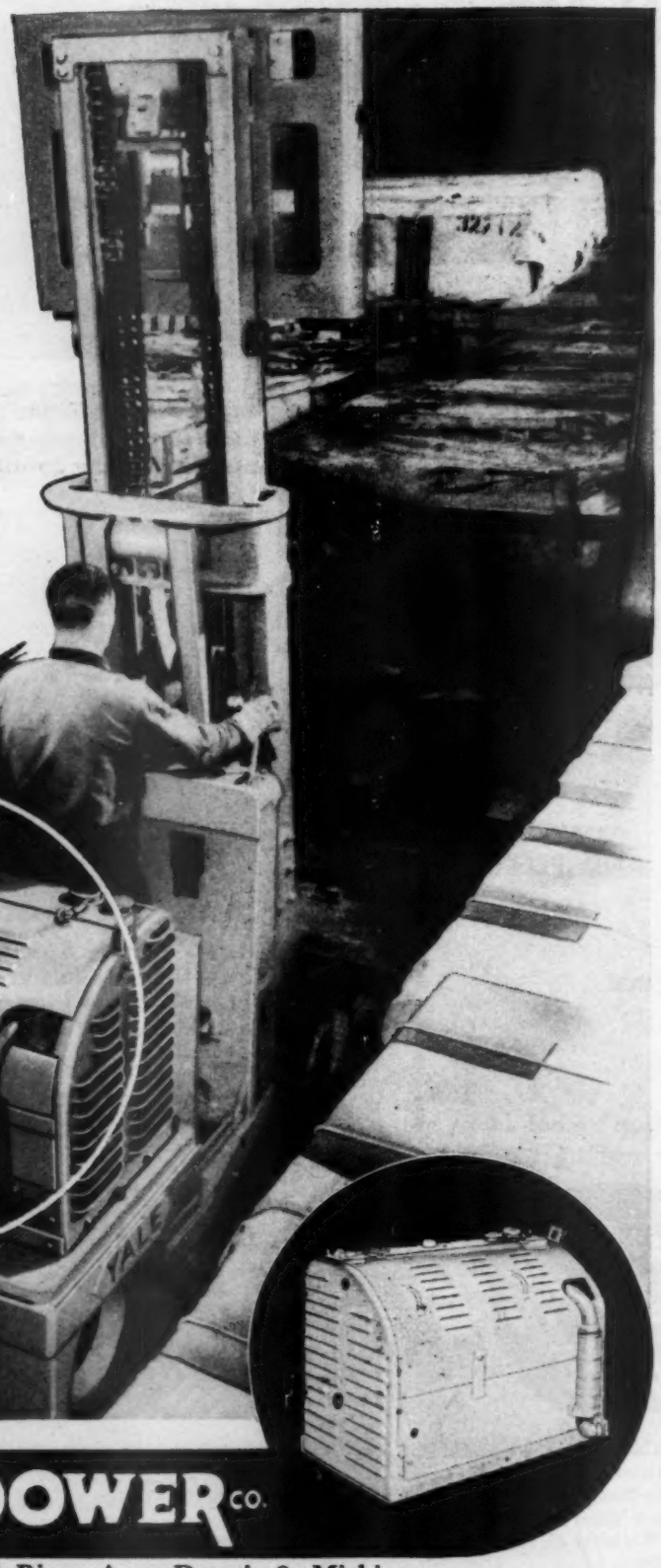
THE UNIFORM texture and thickness of Barrett Specification* Felt are appreciated by experienced architects and contractors. Accurately spaced longitudinal guide lines marked on the felt are an aid to quick and accurate application.

heavy loads need READY-POWER



Ready-Power-equipped Baker truck

There's plenty of power to handle heavy loads all day when trucks are equipped with Ready-Power gas-electric Units. Dependable electric power, generated right on the truck chassis, assures smooth, positive handling. Models are available to meet practically all requirements. Convert any make truck to Ready-Power; specify Ready-Power Units on new truck purchases.



THE READY-POWER CO.

3820 Grand River Ave., Detroit 8, Michigan

power truck abuse, and absorbs blows and bumps. Platforms are corrosion-resistant and non-sparking. Union Metal Manufacturing Co., Canton, Ohio.

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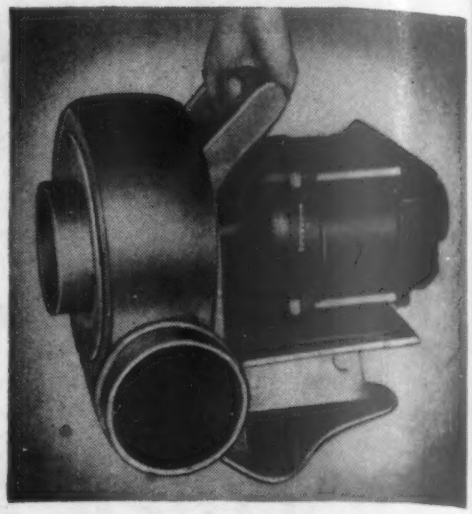

PORTABLE VENTILATOR

Called Saf-T-Air, lightweight, portable, electric-motor-driven ventilator has a 425-c.f.m. capacity. Balanced handle allows it to be carried or hung without tipping. Made of non-corrosive spark-resistant aluminum, maker states it can be connected to lighting or power supply outlet without danger of overloading. Suitable for use as a blower or exhauster, for eliminating hazardous gases, fumes, vapors, dust, and contaminated air from drums, tanks, boilers, and inaccessible places. Its small size allows it to pass through small hatchways and into hard-to-get-at places. United Electric Motor Co., 178 Center St., New York 13

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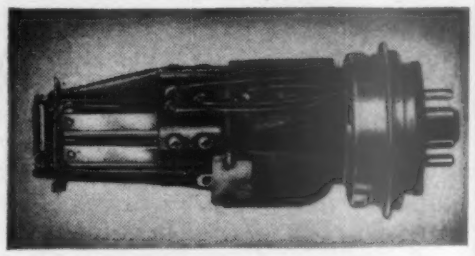


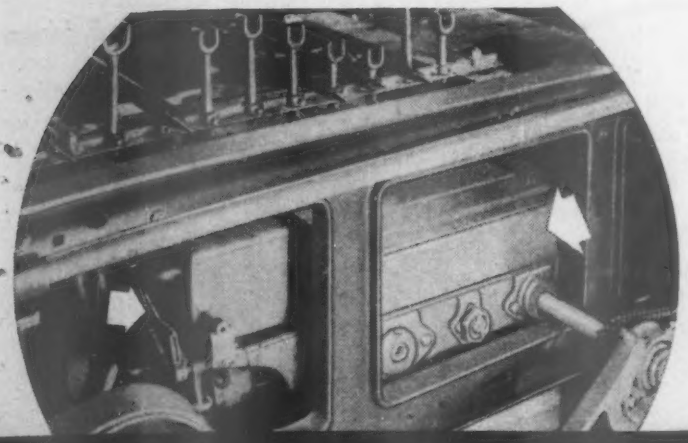
MULTIPLE-ARM RELAYS

Line of small, general-purpose multiple-arm relays is suitable for control circuits and systems. Features claimed include minimum mounting area; vertical, balanced armature, interchangeable unit contact pile-ups; and high contact pressures. Said to be shock- and vibration-resistant. Three assemblies are available: Octal socket with removable dust cover, or with hermetically sealed cover; and header-type container, hermetically sealed. Signal Eng. & Mfg. Co., 154 West 14th St., New York 11.

•

AXIAL FLOW FANS

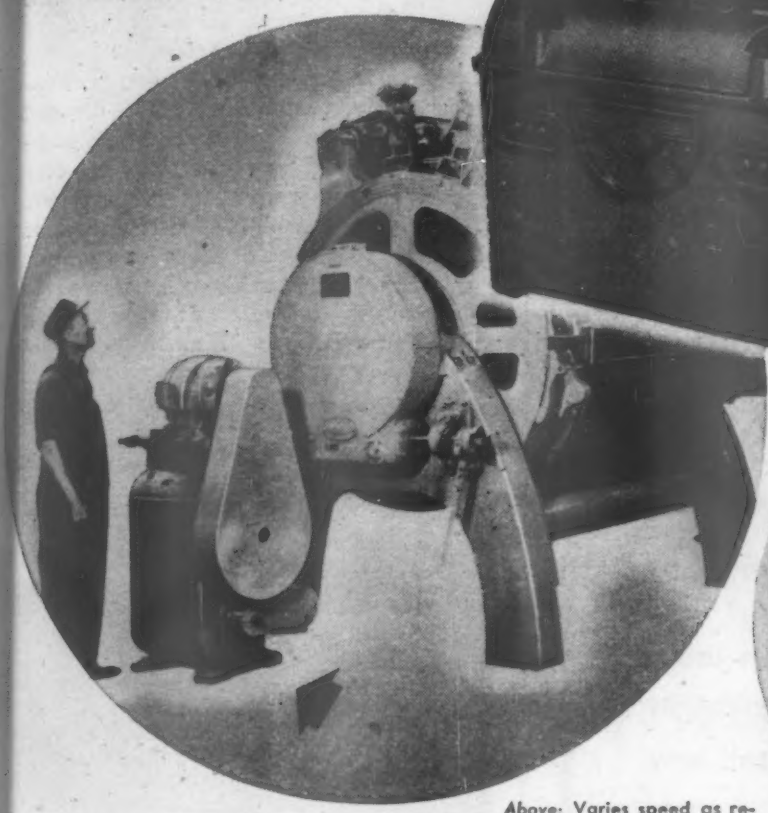
Line of Axivane adjustable-blade fans, Series 1000, is suitable for heating, ventilating, and air conditioning requirements. Consists of axial-flow fans of the vane-axial type, for a range of pressures up to 9.60 water gage and volumes up to 100,000 c.f.m. They are available in 124 different models, from various combinations of 15 different housing diameters, 18 to 60 inches, 4 hub sizes, 16 motor-frame sizes, and 4 different



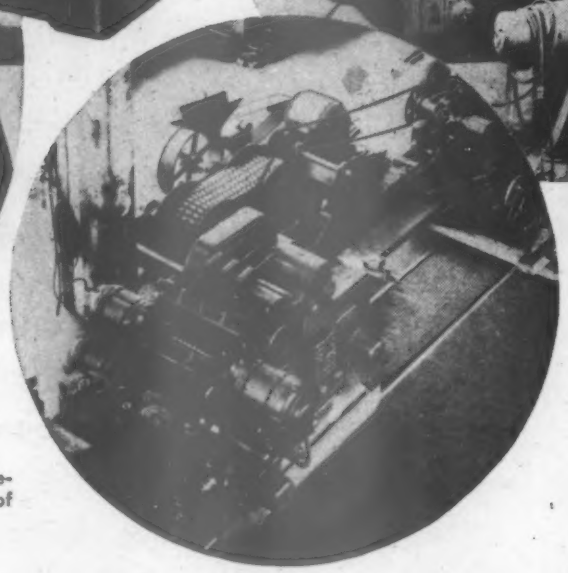
REEVES Variable Speed Transmission

Above: Accurately controls baking time of bread in direct gas-fired tunnel oven.

Above: Maintains constant tension, reduces stretch of yarn on slasher in textile mill.



Above: Varies speed as required in filter processing of synthetic rubber.



Above: Regulates speed of rotary table on welding positioner, for continuous weld.

Left: Provides infinite speed adjustability on lumber planer and matcher.

Provides infinite, accurate speed flexibility within 2:1 to 16:1 ratio

Proved in thousands of installations in scores of industries, REEVES Variable Speed Transmission is the original compact and mechanically correct unit which drives production machines at infinitely variable speeds—making available instantly the most efficient speed for each different operation. It covers the entire speed range smoothly, without steps and without interrupting production . . . maintains any desired speed without fluctuation. Available in sizes fractional to 87 hp, both horizontal (illustrated) and vertical types, either open or enclosed designs. Choice of manual (handwheel), electric remote (push button) or entirely automatic controls.

Also in the complete line of REEVES Speed Control equipment are two other basic units—the Motodrive and the Vari-Speed Motor Pulley—likewise offered in the widest selection of designs, sizes, speed ratios and controls.

By providing the right speed for every job, under every changing condition, REEVES Speed Drives are assuring better quality products, higher rates of production and lower manufacturing costs in more than 260,000 widely diversified industrial installations and as standard equipment on more than 2,100 different makes of machines.

A REEVES engineer experienced in your field will be glad to consult with you. For information on the entire REEVES line, write today for the comprehensive 114-page catalog F-450A.

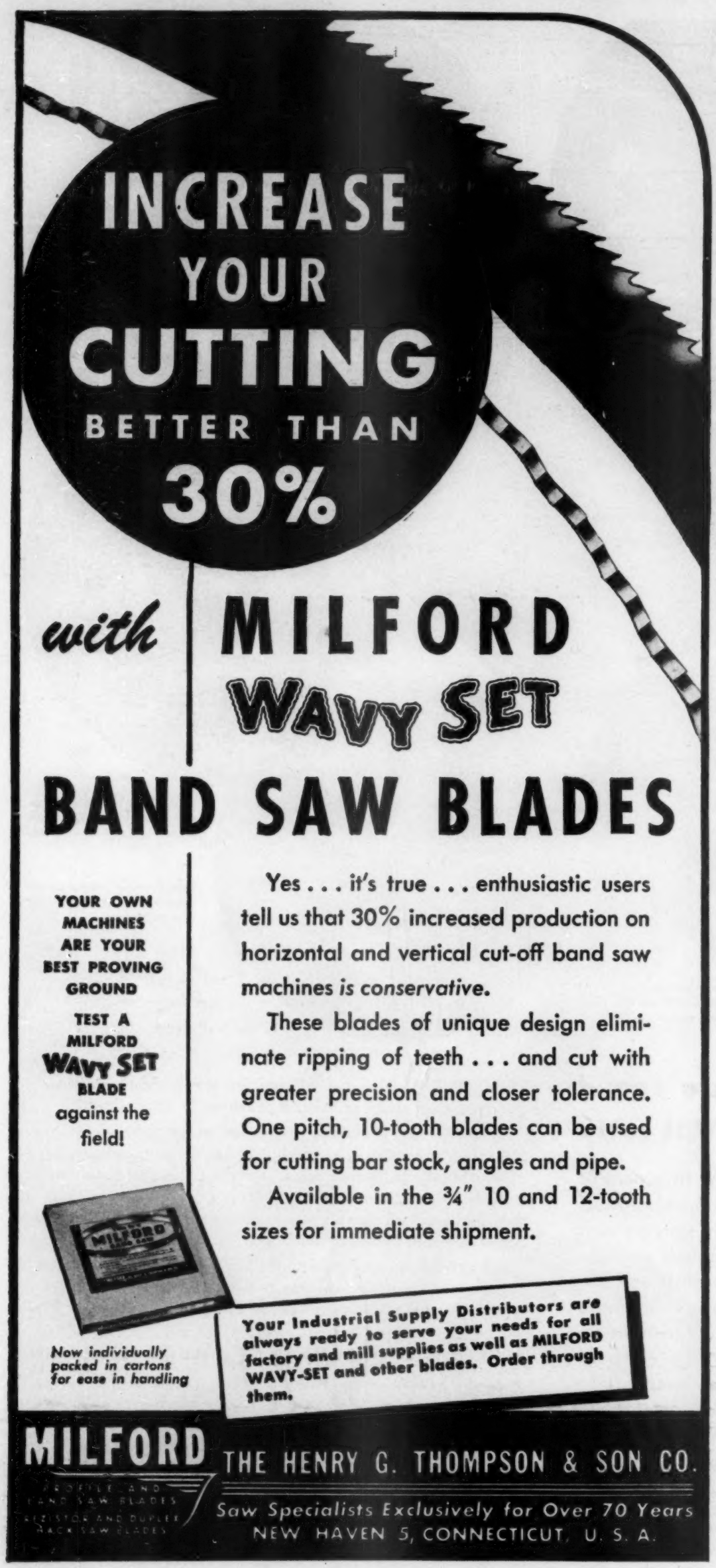
REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

ACCURATE • VARIABLE

Reeves Speed Control

GIVES THE RIGHT SPEED FOR EVERY JOB!


INCREASE
YOUR
CUTTING
BETTER THAN
30%
with
MILFORD
WAVY SET
BAND SAW BLADES
YOUR OWN MACHINES ARE YOUR BEST PROVING GROUND
TEST A MILFORD WAVY SET BLADE against the field!
Yes . . . it's true . . . enthusiastic users tell us that 30% increased production on horizontal and vertical cut-off band saw machines is conservative.
These blades of unique design eliminate ripping of teeth . . . and cut with greater precision and closer tolerance. One pitch, 10-tooth blades can be used for cutting bar stock, angles and pipe.
Available in the ¾" 10 and 12-tooth sizes for immediate shipment.
Now individually packed in cartons for ease in handling
Your Industrial Supply Distributors are always ready to serve your needs for all factory and mill supplies as well as MILFORD WAVY-SET and other blades. Order through them.
MILFORD
THE HENRY G. THOMPSON & SON CO.
Saw Specialists Exclusively for Over 70 Years
NEW HAVEN 5, CONNECTICUT, U. S. A.

speeds. The simplified design, with direct-, in-line drive, is said to lower installation costs, minimize space requirements, and develop maximum volume and pressure per pound of fan and motor. Joy Mfg. Co., Oliver Bldg., Pittsburgh 22.

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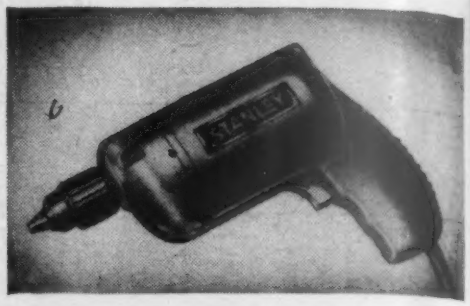

ELECTRIC DRILL

Portable ¼-in. capacity electric drill, No. 24, is 8½ inches over-all, and weighs 3¼ pounds. It is suitable for working in close quarters on metal, wood, and composition materials. Features include an aluminum die-cast housing, trigger-type switch with locking device, Jacobs chuck, positive cord clamp, three-wire, rubber-covered cord with spring protector. Can be converted into bench drill by locking into No. 514 stand bracket which can be moved up or down or sideways. Stanley Electric Tools, New Britain, Conn.

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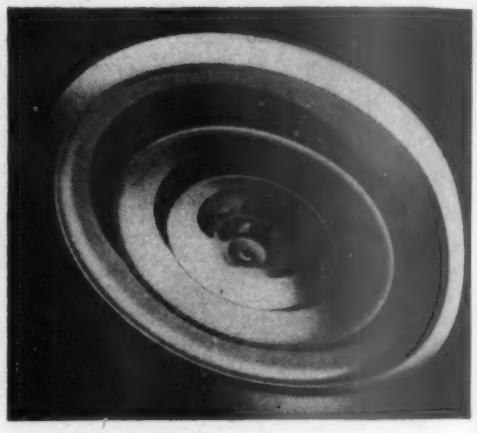
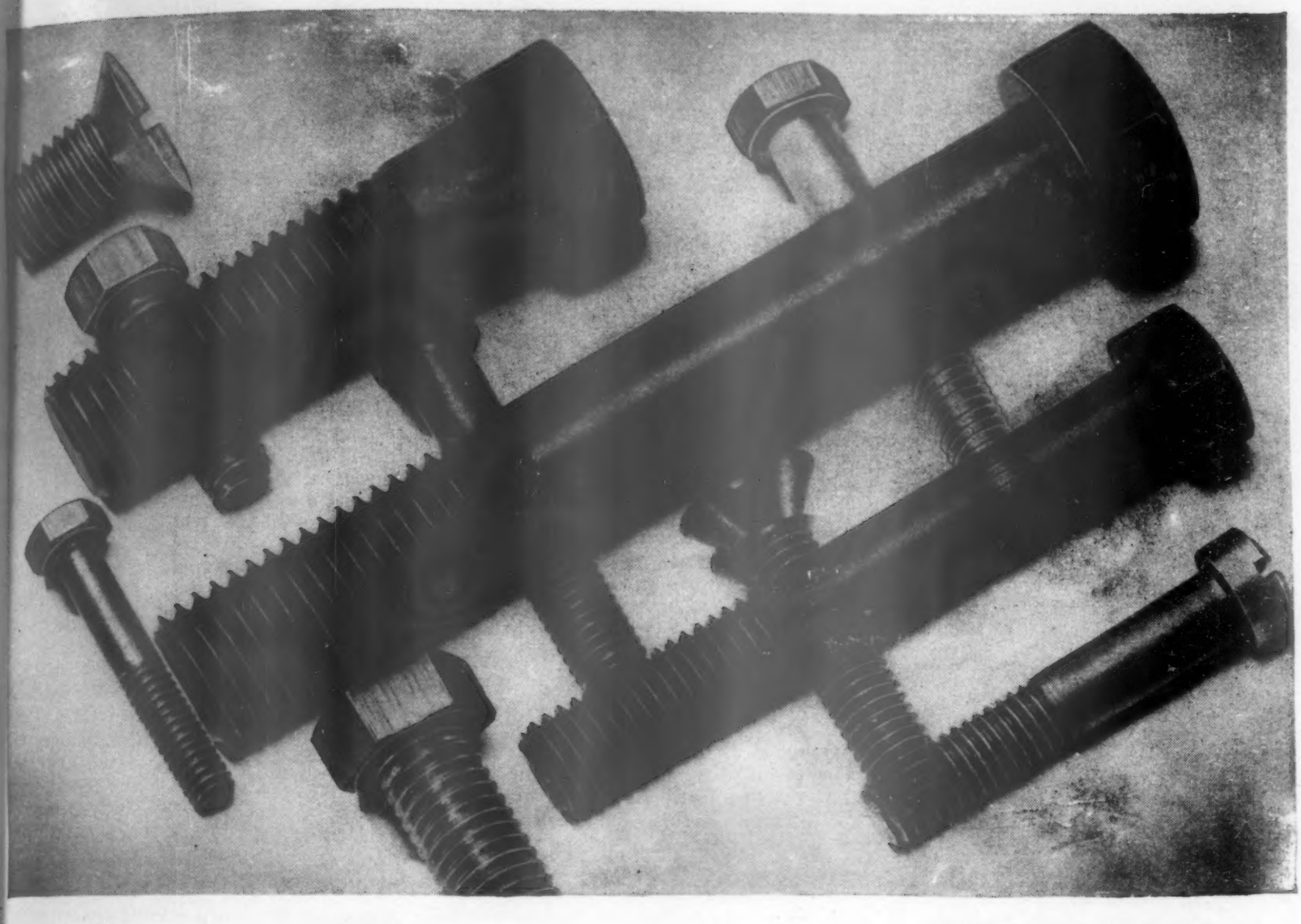


AIR DIFFUSER

Knob on air diffuser provides for any desired air flow pattern. An adjustment mechanism varies the vertical position of the third cone, producing different air flow patterns ranging from draftless diffusion to downward projection, without affecting air resistance. It utilizes an aspiration principle which draws in room air and mixes it with supply air. The amount of air drawn in depends on the adjustment setting and varies from 15 to 35 per cent. The Type C-1 unit can be used for heating, ventilating, or cooling, in any combination. The air flow can be adjusted to neutralize the effect of local sources of heat gain or loss, or air distribution problems caused by beamed ceilings, nearby walls, or columns. May be mounted flush to the ceiling, or on exposed ductwork. Adjustment is made by remote automatic or manual control. Pneumatically operated control equipment may be used to adjust any number of diffusers simultaneously, according to the manufacturer. Anemostat Corp. of America, 10 East 39th St., New York.



IT'S "t.f.e."

TO FASTEN QUALITY WITH QUALITY

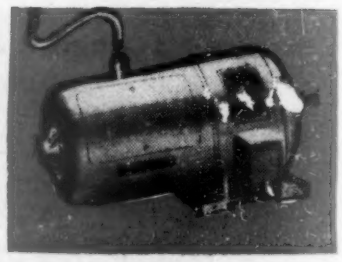
Purpose of a fastener is to fasten. So the cheapest fastener is the one that fastens *best*, with minimum time for assembly, maximum holding power per dollar, and the ultimate contribution to the finished product's appearance.

Manufacturers of machinery and equipment have learned that specifying RB&W Cap Screws saves money all along the line. RB&W's investments in spheroidizing furnaces to improve structure of high carbon and alloy steels . . . mills to draw its own wire to closest tolerances . . . atmospheric-controlled furnaces for scientific heat treatment . . . are as important as the modern production machines in contributing to *True Fastener Economy*.

On *any* problem involving bolts, nuts, screws, rivets or specials, RB&W engineers will help you attain *True Fastener Economy*.

DESIGNING FOR T.F.E. Correct use of RB&W Cap Screws often permits reduction in number and size of holes, saving time and increasing strength of assembly.

CAP SCREWS FOR SEVERE SERVICE. Uniformly high strength, maximum toughness and adherence to close tolerances equip RB&W Cap Screws for severe stress conditions.



SUPERIOR APPEARANCE. The superior finish of RB&W Cap Screws enhances the appearance of the assembly and contributes to the sales value of the final product.

t.f.e.

TRUE FASTENER ECONOMY
IS THE LOWEST TOTAL OF ALL
FASTENING COSTS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

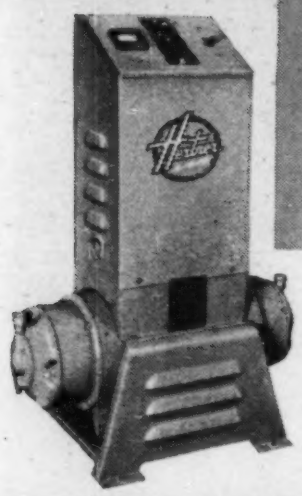
BOLTS • NUTS • SCREWS • RIVETS
RB&W
THE COMPLETE QUALITY LINE
& ALLIED FASTENING PRODUCTS

Plants at: Port Chester, N. Y., Coraopolis, Pa., Rock Falls, Ill., Los Angeles, Calif. Additional sales offices at: Philadelphia, Detroit, Chicago, Chattanooga, Oakland, Portland, Seattle. Distributors from coast to coast.

103 Years Making Strong the Things That Make America Strong

Automatic
MOTOR-GENERATOR CHARGING
with the
HERTNER
TYPE "H" SINGLE CIRCUIT
BATTERY CHARGER

Means longer life for your motorized Lift-Truck Batteries.



Hertner Motor-Generator sets operate at the quiet, long-life speed of 1750 r.p.m.

Completely-Automatic Controls
Prevent Current Losses
Avoid Over-Charges

Economical operation of your motorized lift-trucks depends largely upon low-cost, dependable charging of the batteries—charging that will extend their "life expectancy." With Hertner Type "H" single chargers, there are no current losses through charging resistors. These chargers operate at 1750 r.p.m. and have long life with trouble-free performance.

The charging rate is automatically and positively controlled and the charger automatically shuts off when the battery reaches full charge. Pilot light indicates that charger is operating.

Mail coupon for Bulletin 101 describing Model "H" single-circuit chargers, or Bulletin 102 describing Model "H" multiple-battery chargers.

The* HERTNER *Electric Co.
A General Precision Equipment Corporation Subsidiary
Motors • Motor Generators • Generator Sets
CLEVELAND 11, OHIO
Representatives in principal cities

THE HERTNER ELECTRIC CO.
12750 Elmwood Ave., Cleveland 11, O.
Send: Bulletin 101 ☐ Bulletin 102 ☐
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City_____ State_____

SIGNIFICANT LABOR DEVELOPMENTS

BENJAMIN WERNE, Lecturer on Government Regulations, New York University, and a Member of the New York Bar

Period Surveyed: January 1 to February 1

TREND INDICATORS
Wage Hour

CHANGE IN PAY METHOD CIRCUMVENTED WORKER'S RIGHTS TO OVERTIME

The accepted method for determining the rate of hourly pay for employees paid on a monthly basis is to multiply the monthly salary by 12 to obtain the total pay for the year, then to divide the sum by 52 to obtain the pay per week; this sum in turn is divided by the number of hours worked during the week. This method produces the "regular rate of pay" upon which overtime is to be computed under the Act.

In the instant case the employee had been paid at a monthly rate for some time. The company, however, called him in and told him that for the convenience of the payroll department, he would be paid on an hourly rate. After being assured that the change would not make any difference to him and that he would continue to receive the same amount of money, the employee signed the "change of rate" slip. During the period the employee worked under this new arrangement he was entitled to be paid for overtime since it could not be shown that there was a new and valid contract between the parties.

The court held that such changes in methods of payment are valid only if they are the result of fair and open negotiation between the parties, and if the employee knows what he is doing. However, where a contract or an arrangement produces an artificial "regular rate" the court will not sanction it. (McCloskey v. Dickinson, Municipal Court of Appeals. D. C.)

BELO CONTRACT NOT VALID

The court refused to uphold a Belo contract where the employees actually were given monthly wage increases with no changes made in the contracts. In each instance, the employee was advised orally of the increase in his monthly salary but signed no new contract and was not advised of any change in the hourly rate or of any change in the weekly guarantee. Although the contracts provided for an hourly rate and for overtime payments for extra hours, the company's books did not record the number of hours worked by the employees. The court also found that at no time did the company pay any of these employees any sum in excess of the minimum weekly guarantee provided in the contract. (McComb v. Sterling Ice Company, CCA-10)

WAGES PAID TO EMPLOYEES INCLUDED MEALS

Wages paid to any employee include the reasonable cost, as determined by the Administrator, to the employer of furnishing such employee with board, lodging, or other facilities, if such board, lodging or other facilities are customarily furnished by such employer to his employees. Meals, which a railway furnished to its dining car waiters, which were eaten by the waiters on their own time, constitute a part of the waiters' wages. The meals were not part of the working condition since they were eaten by the waiters on their own time. The court further held that such additional wage or price was not paid primarily as a convenience to the railway. (Southern Pacific Company v. Joint Council; CCA-9)

HELD EXEMPT

A foreman in a meat-packing plant, who was in charge of the chill room department, was an exempt employee. The court found that employee's duties included the authority to hire or fire other employees, and that his suggestions and recommendations as to the hiring or firing, advancement, promotion, or other change of status of other employees were entitled to particular weight. The employee customarily and regularly exercised discretionary powers in the performance of his duties which included keeping daily records of his department, supervising the movement of meat, directing the spacing and arrangement of the meat. At no time did the time spent by the employee in non-exempt work exceed 20 per cent of the number of hours worked in the work week by non-exempt employees under his direction. (Smith v. Kerr; USDC W. Tenn.)

WAGE RE-OPENING DOES NOT ALLOW RE-EXAMINATION OF BASIC WAGE RATES

Where the re-opening clause of the contract provided that "the basic straight and overtime rates shall at the request of either party be reviewed," an arbitrator held that the clause does not permit a complete re-examination of the fairness of the basic wage rates in the light of all pertinent wage determining factors. "The clause was intended to supplement the annual collective bargaining process by permitting a mid-term wage adjustment to meet changing conditions during a period of economic instability. The review which it provides is only a review of the most recent wage

— A *Finnell* SCRUBBER-VACUUM DOES ALL . . . at *BIG* Savings in Labor Costs!

Clean floors—so important to worker safety and morale—reflect good management. Large-area floors that are cleaned with a *Finnell Combination Scrubber-Vacuum* reflect good management for still another reason. They tell a story of big savings effected in labor costs. For example, the *Finnell Scrubber-Vacuum* illustrated above, with one or two operators, does a cleaning job better in half the time it takes a crew of six to eight using separate equipment for scrubbing and picking up. This *Self-Propelled Finnell* is a complete cleaning unit *all in one*—it applies the cleanser, scrubs, rinses if required, and picks up. Has a cleaning capacity up to 8,750 sq. ft. per hour!

Finnell offers several *Combination Scrubber-Vacuum Machines*, and also a full line of *Portable Floor-Maintenance Machines*. In fact, *Finnell* makes equipment for every type of floor care—wet scrubbing, dry scrubbing, dry cleaning, waxing, and polishing—and in sizes designed to fit specific needs. *Finnell* also makes a full line of *Cleansers* specially developed for the greater speed of mechanical scrubbing . . . and *Sealers*, *Waxes*, and *Accessories* for every need.

The nearby *Finnell Floor Specialist and Engineer* is readily available for free floor survey, demonstration, or consultation . . . and for training your maintenance operators in the proper use of *Finnell* equipment. Phone or write nearest *Finnell* branch or Finnell System, Inc., 2503 East St., Elkhart, Ind. Canadian Office: Ottawa, Ont.

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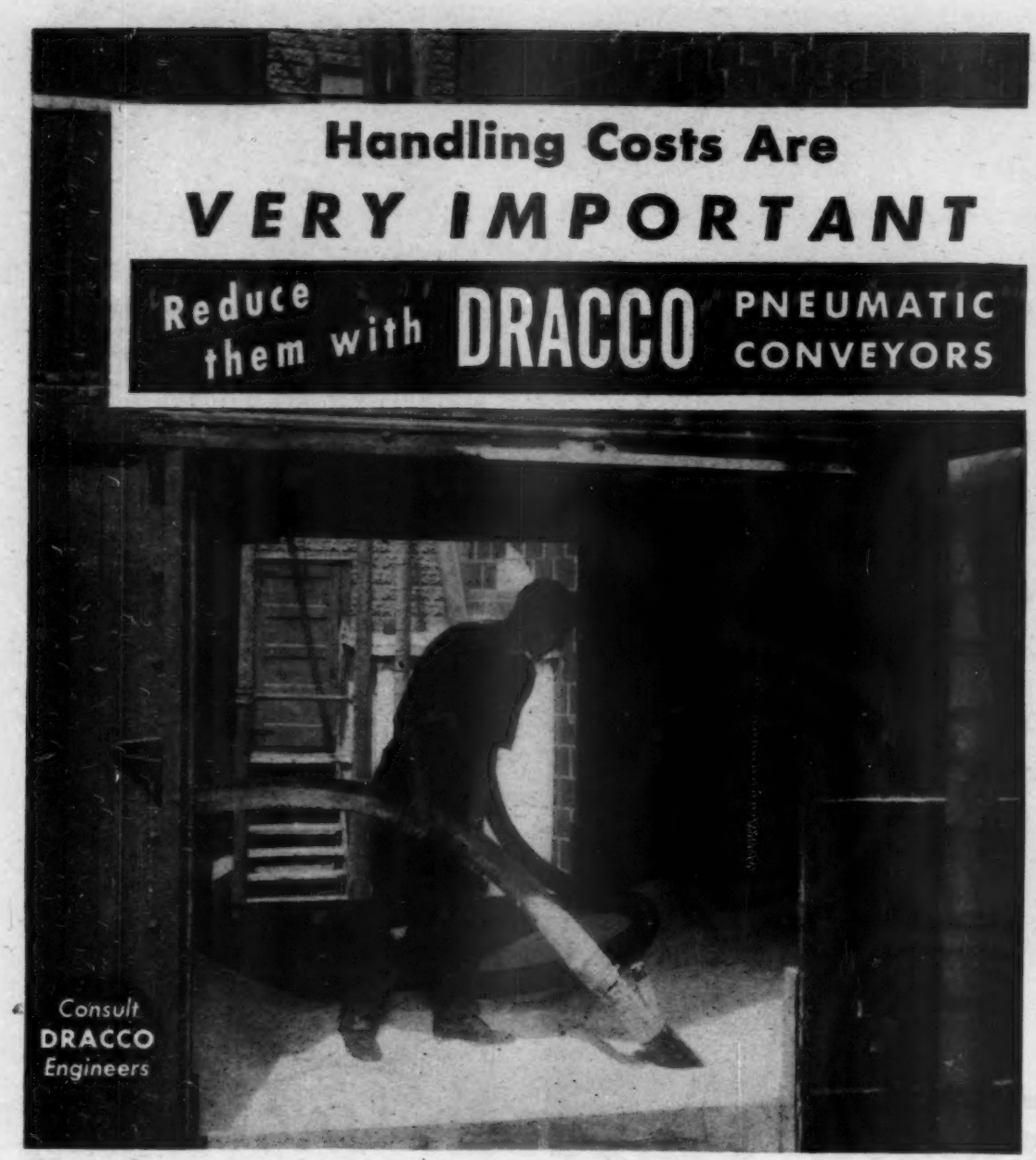
FINNELL SYSTEM, INC.
Pioneers and Specialists in
FLOOR-MAINTENANCE EQUIPMENT AND SUPPLIES
BRANCHES IN ALL PRINCIPAL CITIES



The eyes of Industry are focused on the problem of handling materials as the most logical means of reducing costs. Many plants efficient in every other way can reduce handling costs. If you move chemicals, grains and granular materials it is possible that DRACCO Pneumatic Conveyors can save you considerable money. It will pay to reduce the cost of this operation to the minimum. Why not consult DRACCO Engineers? They have over 30 years experience reducing handling costs in hundreds of plants. They can probably reduce yours.

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standards established by collective bargaining, primarily upon the basis of events occuring since their adoption by the parties." (In re arbitration between Waterfront Employers Association of Pacific Coast and International Longshoremen's & Warehousemen's Union)

PRODUCTION BONUS INCLUDED IN RATE

A production bonus, which was the difference between the contractor's estimated production costs on a commodity and the lower actual cost, must be included in the employees' base rate of pay, for the purpose of computing overtime. Such a bonus, it was found, was divided equally among employees in a given group or unit, regardless of the fact that their rates of pay varied, provided all the employees worked a full schedule of hours. (Lovknit Manufacturing Co., Inc.; Decision of Hearing Examiner Under Public Contracts Act)

COST-OF-LIVING ADJUSTMENT CANNOT BE WITHHELD

An employer cannot deny a cost-of-living adjustment to his employees claiming the large rise in costs and the allegedly great reduction in labor and efficiency. Employees cannot be penalized for such difficulties as out-of-date technology, high cost of materials, and shortage of skilled craftsmen, since inefficiency and high costs in the industry are caused by a variety of factors. (In re arbitration between Associated General Contractors and International Union of Operating Engineers)

UNION MUST PROVE THAT EMPLOYEE SHOULD RECEIVE MERIT INCREASE

Where the union contends that the employer's refusal to grant an employee a merit increase was arbitrary and discriminatory, the burden of proof is on the union. Since the contract recognized the company's right fully to manage and control its business and operations, management's exercise of its discretion should not be lightly treated by an arbitrator. "In order to set aside a practical decision of management, then, such as the denial of a merit increase, it is not sufficient to show merely that a difference of opinion exists between the union and the company on the relative worth of the employee involved or on how much significance should be attached to his previous experience and training in evaluating his ability." (In re arbitration between McInerny Spring & Wire Company and United Automobile, Aircraft & Agricultural Implement Workers of America)

LABOR-MANAGEMENT RELATIONS

***EMPLOYER'S RIGHT TO DELIVER SPEECHES**

An employer had the right to deliver to his employees, pre-election speeches

*In this classification, items marked with an asterisk also are considered to be trend indicators.

FAMOUS QUOTES

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"GET THERE FUSTEST
WITH THE MOSTEST"*

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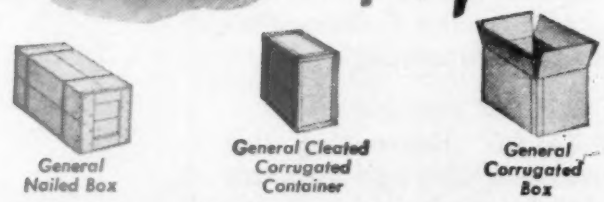
Our Designing and Testing Laboratories at Chicago and Brooklyn are staffed by packaging engineers of long experience. They will be glad to help you design a more economical and more efficient container for your product.

Write today for complete information . . . also for your free copy of "The General Box."

** Statement of Nathan Bedford Forrest (1821-1877), great Confederate cavalry leader. Volunteered as private in 1861; made a major-general in 1863.*



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that were objective in their approach and did not convey the idea, either openly or by intimation, that the employees would suffer reprisals if they joined the union or if the union won the election. By his speeches, the employer justified his wage policies and discussed the arguments of the union in detail. The employees were repeatedly assured that they had a right to join the union if they wished, and to vote for it in an election without fear of retribution. (Sohio Pipe Line Company and Oil Workers International Union; NLRB)

***DISCHARGE JUSTIFIED FOR EXCESSIVE ABSENTEEISM**

An employer was justified in discharging an employee who was absent 14 to 15 weeks of a 7-month period, despite the fact that the employee's absences were caused by illness. Although genuine illness justifies occasional absences, where an employee is so habitually ill or suffering from injury as to make his services of no value to the company, the company is under no obligation to retain him. The arbitrator brought out the point that no plant can operate profitably unless it can count upon the fairly regular attendance of employees. (In re arbitration between Celanese Corporation of America and Textile Workers Union of America)

***EMPLOYER JUSTIFIED IN DISCIPLINING EMPLOYEE**

An employer was justified in disciplining an employee who refused to perform the job as directed. Such a refusal by the employee was just as insubordinate as an outright refusal to work, since the evidence disclosed that the directed manner of operation entailed no hazard to health or safety. The arbitrator ordered that the employee's indefinite suspension should normally be ended within a reasonable period of time, but not before the employee recognizes his error. (In re arbitration between Thompson Products, Inc., and United Automobile, Aircraft & Agricultural Implement Workers of America)

***EMPLOYER'S RIGHT TO ESTABLISH A RETIREMENT PLAN**

An employer has the right to establish a retirement plan where the contract contains no specific contract provision restricting this right. The union claimed that the company had no right to "lay off" the men involved as it violated the seniority provision of the contract. The company, on the other hand, argued that it was within its prerogative to "retire" them under the provisions of its retirement and pension plan. The arbitrator pointed out the fact that a union does not have any proper ground to complain when the company is carrying out a plan which seeks to solve the problem of providing for superannuated employees so long as the carrying out of the plan is not discriminatory. In the instant case, the company and the union entered into a collective bargaining agreement after the retirement plan had

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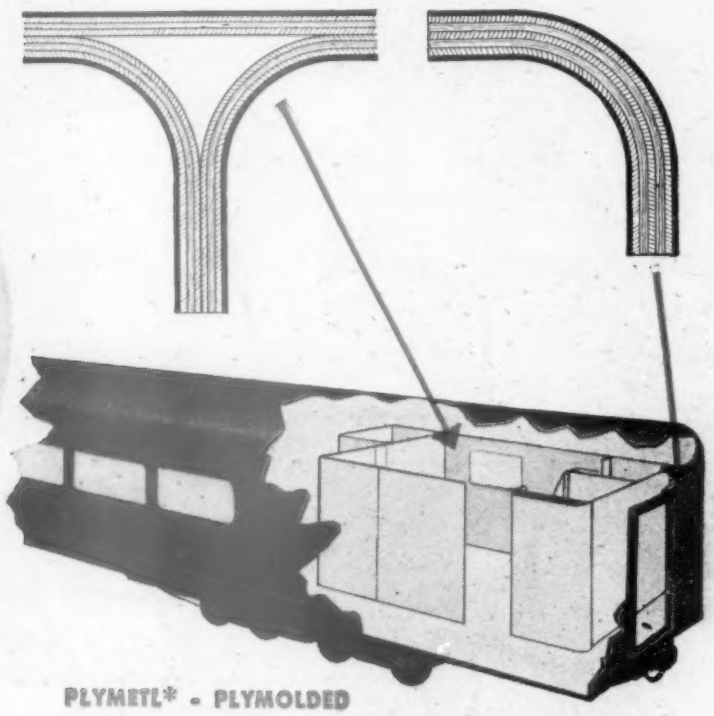
The Haskelite PLYMOLD process permits molding to either simple or compound curvatures, depending upon the material. Fine plywoods and other composite materials such as Haskelite Plymetl — the metal-faced plywood; Plastiply — resin impregnated sisal, cloth or paper; Fybrwood — fiber-faced plywood, have been molded by this process.

Through PLYMOLD these materials, widely known and used in flat sheets, now have a still greater scope of application. You can select any one or more combinations whose basic characteristics of strength, light weight and beauty give your product the greatest advantages "saleswise," and give you the most savings "productionwise" . . . parts of the materials selected will then be furnished you in volume quantities PLYMOLDED to your specifications.

The few applications shown below may help direct you to an answer that will mean lowered production costs, or greater beauty and sales appeal for your product through the Haskelite PLYMOLD process.

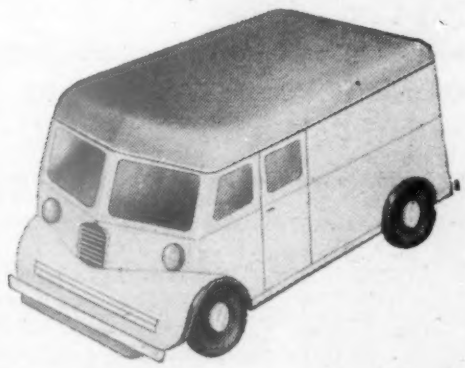


PLYMETL* - PLYMOLDED

Haskelite Plymetl, the metal-faced plywood is PLYMOLDED to form standard rounded corner sections. For use with panels of the same material for interior partitioning and construction of washroom sections and roomette type section in modern passenger cars.

HASKELITE* - PLYMOLDED

The curved plywood housing for this modern automatic record player, manufactured by AMI, Inc., is PLYMOLDED in volume quantities.



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Resin impregnated fibrous materials will be PLYMOLDED into one-piece roofs. These are proposed for use on delivery vehicles, station wagons, etc.

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been announced, and the contract in way mentioned the retirement plan placed any limitation upon the compa in regard to it. (In re arbitration b tween American Salt Corporation a International Chemical Workers Union

***EMPLOYER'S DUTY TO SEE THAT EMPLOYEES JOIN UNION**

Where the contract provides that new union employees shall make application for membership in the union within days from the date of hiring and shall become members of the union within days from such date, the employer has the duty of seeing to it non-union employees join the union within the prescribed period, and of discharging them if they do not do so.

While the union shop clause of the contract did not expressly provide that if the non-union employees fail, within 30 days of hiring, to join the union the employer must discharge them, the court held that such a provision must be implied from the very nature and purpose of the contract. The company contended that the clause was inserted only to induce action on the part of non-union employees, with no duty on the employer to require such employees to comply as a condition of employment. The court held that the company's contention disregarded the fact that the contract is between the union and the employer, and the non-union employees are not parties to it. The contract imposes obligations on the union and the employer, and not on persons who are not parties. (Silva v. Mercier; Calif. Dist. Ct. of Appeals)

***EMPLOYER NOT GUILTY OF INTERFERENCE IN REFUSAL OF MEETING HALL**

The Labor Management Relations Act does not require an employer to treat a labor union in the same manner as it treats other persons or organizations which are not concerned with the interests or activities of labor. Thus, an employer did not commit an unfair labor practice where he refused to allow the union to use the assembly hall in the company building in a company town for the purpose of holding a meeting to organize his employees. Even though the employer's action was inspired by hostility to the union, the refusal did not amount to unlawful interference, restraint, or coercion. The court could not uphold the board's finding that the employer was guilty of an unfair labor practice, since the practical effect of such a holding is to require the owner to maintain the building for union purposes whenever it suits the convenience of the union to requisition it, and to that extent to require him to surrender his property rights. There can be no doubt that if such a compulsion were exercised by the government for its own purposes, there would be a deprivation of property without due process of law. If the surrender of the property against the will of the owner were compelled by any private person other than a labor union, no one would deny that a deprivation of

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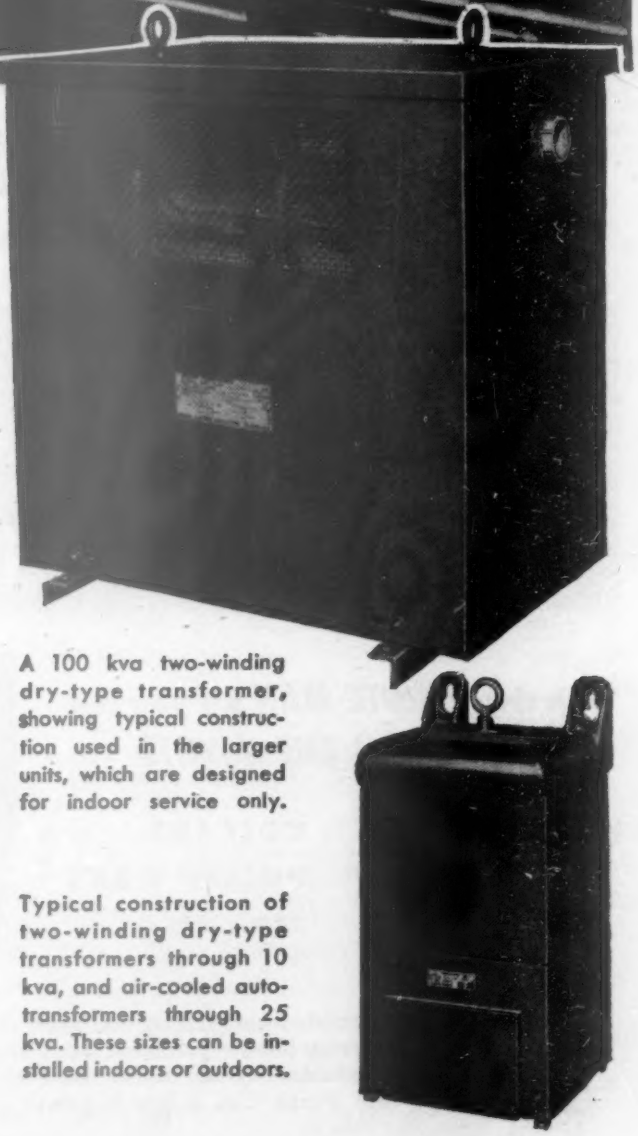

A 100 kva two-winding dry-type transformer, showing typical construction used in the larger units, which are designed for indoor service only.

Typical construction of two-winding dry-type transformers through 10 kva, and air-cooled autotransformers through 25 kva. These sizes can be installed indoors or outdoors.

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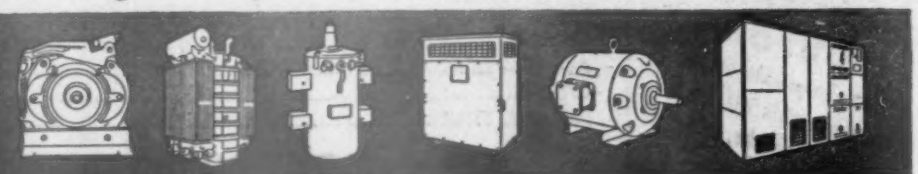

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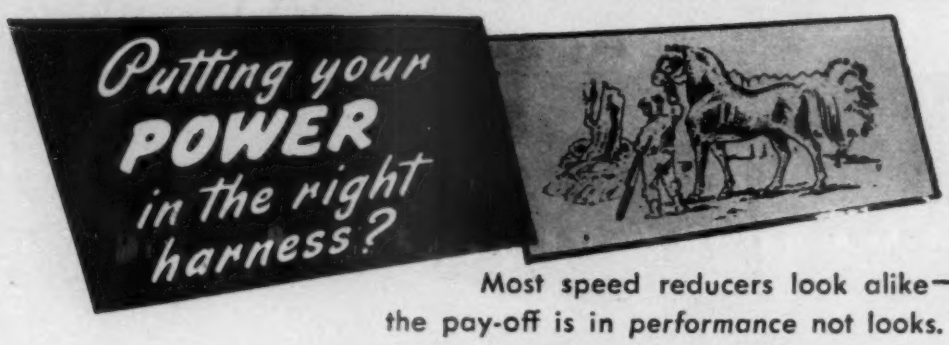

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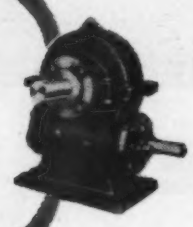

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With this *MINUTE MAN* kit you can cut keyways *IN ONE MINUTE*

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property without due process had occurred. (NLRB v. Stowe Spinning Company, CCA-4)

***UNION HAS RIGHT TO DISTRIBUTE PROPAGANDA DURING CAMPAIGN**

The board did not order an election set aside where the union distributed circulars, during a pre-election campaign, allegedly false and misleading accusations against the employer. Such material used by the union constitutes propaganda, and the employer has ample opportunity to counteract the union's assertions. The board points out that there is no real danger in leading to the sense of the voter the job appraising such election practices of unions. (Carrollton-Furniture Manufacturing Company and International Union, United Automobile Workers of America; NLRB)

***BY HONORING PICKET LINE UNION VIOLATED ITS CONTRACT**

Under a contract clause which read "There shall be no strikes, stoppages of work, or slowdowns by the employees nor any lockouts by the employer during the life of this agreement," a union which honored the picket line of another union was guilty of violating its contract. The union admitted that its members "quit more or less in sympathy with the other union, but nevertheless claimed that its members were entitled to pay for the holiday which fell during the period when its members stayed away from work. The union argued that its members would have been out of work anyway within a day or so after the strike began, inasmuch as their work depended upon the output of the employees who were on strike. The company contended, however, that the union's failure to report for work constituted a work stoppage rather than a loss of employment due to a work stoppage by another group of employees. The arbitrator agreed with the company and held that the union's mass absence was a violation of the contract, and that they are not entitled to pay for a holiday which fell during this period when the violation took place. (In re arbitration between New England Master Textile Engravers Guild and United Textile Workers of America-AFL)

***EMPLOYEE ENTITLED TO HOLIDAY PAY**

Under a holiday clause which provided that "employees must work the last regularly scheduled work day preceding a holiday and the first regularly scheduled work day following a holiday," an employee who was absent on part of the days before and after the holiday is entitled to holiday pay. On each of the days the employee requested his supervisor for permission to take the time off as he needed this time to assist his mover in moving into his home. The union contended that the contract clause did not require an employee to work a full day preceding or following the holiday, and in view of the fact that the employee worked 5 hours on each of the days, he

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Flintkote Mastic being applied to the inside surface of cinder-concrete masonry wall. Wall is coated from floor to ceiling.

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Flintkote Spandrel Cloth protects beam from moisture which might penetrate the brick or mortar joints.

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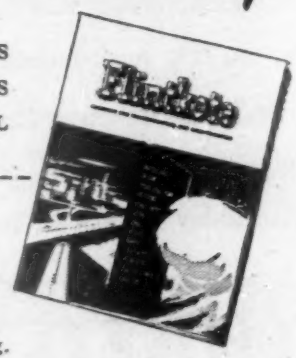

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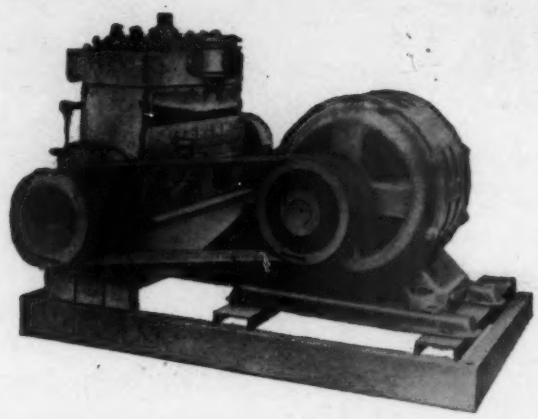

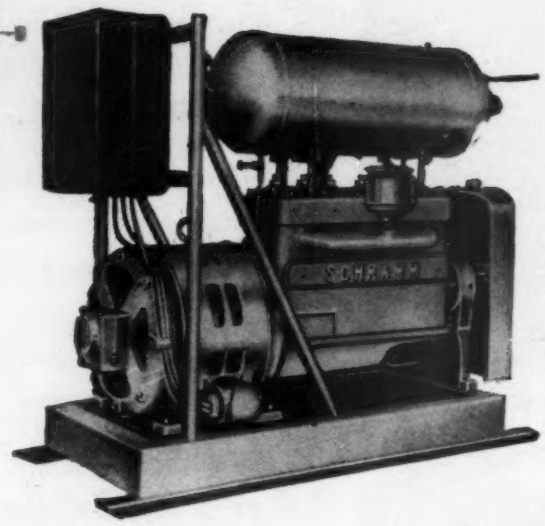

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At almost every turn you need compressed air!

The check list (at right) indicates some of the many compressed air jobs to be done, all of which are accomplished easily, quickly and economically with Schramm Air Compressors.

Here's *why* you profit, as others have, by using Schramm: they're compact, lightweight, easy to start; built for rugged jobs, to provide a continuous flow of air.

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was entitled to be compensated for s holiday.

The arbitrator ruled that the intent the clause was to have a worker wo on the date preceding and the day fo lowing in the same manner as he would ordinarily be expected to work on a re ular scheduled work day. "Ordinarily worker is not considered to be absen from work when he reports for wo and does work a substantial part of th day, and absents himself part of the da for proper reason." (In re arbitration be tween The United States Rubber Com pany, Shoe Hardware Division an Industrial Union of Marine & Ship building Workers of America)

*EMPLOYEES ON LAYOFF MAY REFUSE RECALL TO LOWER-RATED JOBS

Employees who are on a layoff may re fuse recall to lower-rated jobs without jeopardizing their seniority rights. The contract provided that seniority would be broken "when an employee quits or is discharged for proper cause; or, if he fails, upon notice to return to work within 3 days. . . ." Under such a con tract clause, a laid-off employee is se cured in the same seniority rights as when he is at work.

However, should a laid-off employee accept a lower-rated job, his action does not constitute a transfer entitling him to his former rate of pay. As pointed out above, if the employee refuses to accept the job, he does not lose his seniority rights; if he accepts the job, he does so voluntarily and with an understanding of the fact that such new work carries a different rate from his former rate. The arbitratior held that the union's claim was neither reasonable nor logical, be cause it would impose an undue burden on the company and would require the payment of different rates for the same work. It was only intended that an em ployee should receive his former rate when he is transferred to a lower-rated job as a convenience to management and by its direction. (In re arbitration be tween Service Conveyor Company and United Steelworkers of America)

*EMPLOYEES ENTITLED TO VACATION AT NEW CONTRACT RATE

Vacation provisions of a contract do not apply only to vacations earned during the term of the new contract. In the in stant case, the company and the union conducted negotiations in respect to a new agreement during May, 1947. (The 1946 agreement terminated June 15, 1947). In this new agreement substan tial increases were made in hourly rates of pay. The company distributed vaca tion pay to its employees June 27, 1947. The company paid vacation pay on the basis of the rates in effect in the old con tract but recognized the new vacation benefit as to length of service, shift premiums, overtime, etc.

The union contended that it has always been its understanding and in tent that the rate of pay for vacations is the rate prevailing at the time of the va cation pay. If the company intended

Bothered by HEAT?

INVESTIGATE G-E SILICONES

Bothered by heat—in your production problems? Then you'll want to investigate General Electric silicones. Because whether you are concerned with the manufacture of airplanes or oven doors, searchlights or diesel engines . . . any product or process where heat presents a problem . . . General Electric silicones have amazing heat-defying properties that can probably prove useful to you.

For example, silicone rubber—an amazing material which retains its elasticity at temperatures as high as 520 F—has been found to be ideal for making gaskets for jet airplane engines. Other motors can benefit by the application of silicone resin insulating varnish to windings. By using this varnish—capable of withstanding a temperature of 355 F—longer life under extreme service conditions may be obtained.

If molding is your business you'll be interested in General Electric silicone oils and greases. Displaying the typical silicone family traits, these products resist heat even at 575 F. This means you may apply them to extremely hot molds to prevent sticking of the binder and molded piece. Silicone oils and greases are real "efficiency experts" when it comes to saving on broken parts and speeding up production.

In the finishing field you'll find G-E silicone resins which impart unusual weather-resistance to paints and finishes. Still another product of General Electric research is DRI-FILM* water repellent materials. They have proved exceptionally effective for treating glass, ceramics, plastics, textiles, and paper.

WANT TO KNOW MORE ABOUT GENERAL ELECTRIC SILICONES? They have other interesting characteristics and their uses are many and varied. Perhaps they are what you are looking for in your particular industry. We'll be glad to discuss them with you. *Chemical Department, General Electric Co., Pittsfield, Mass.*

*REG. U. S. PAT. OFF.

Please address inquiries about G-E silicones to Resin and Insulation Materials Division, Chemical Department, General Electric Company, Schenectady 5, N. Y.

YOU'LL BE HEARING A LOT ABOUT GE SILICONES

GENERAL ELECTRIC

CD48-S18

...for top air output *plus* economy

Davey Model 315

SPECIFY DAVEY DEPARTMENTAL *Compressors*

DAVEY DEPARTMENTAL COMPRESSORS GIVE YOU THESE ADVANTAGES

- Power savings
- Lower air losses
- Maximum air operating efficiency
- Make plant expansions easy and economical
- Eliminate shutdowns due to compressor failures
- Air cooling eliminates water bills
- Ease of installation
- Reduced maintenance and replacement expense

IN LINE with today's trend toward employment of small departmental compressors instead of one large centralized machine, Davey offers a complete line of industrial units.

These are available in 60, 105, 160, 210 and 315 c.f.m. capacities. And every Davey has GUARANTEED LIFETIME VALVES.

DAVEY COMPRESSOR CO. • KENT, OHIO

Write for Bulletin E-219

DAVEY

P & P-102

DAVEY COMPRESSOR CO. *Dealers in Principal Cities*

It's Easy with

HYDEE HANGER

Just connect wires, screw to outlet box and your chain suspension fixture is hung—in a few minutes. All it takes is a screwdriver!

Complete with receptacle, two 5-foot chains, "S" hooks and cord clips. Fits standard 4" or 3¼" outlet box or plaster ring. Self-grounding—regular 2-wire cord and plug may be used. $1.65 each list

Day-Brite Lighting, Inc., 5441 Bulwer Ave., St. Louis 7, Mo. Nationally distributed through leading electrical supply houses.

In Canada: address all inquiries to Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

Patent No. D-141024, others pending. Underwriters approved.

321

IT'S EASY TO SEE WHEN IT'S DAY-BRITE *Lighting*

to pay the rates of the old cont for vacation purposes, it should h brought this up during contract nego tions. The union pointed out that company by its own action recogn that the new vacation benefits appl the vacations due in 1947, since granted two weeks' pay to employee 5 or more years' service, and the o new benefits.

The arbitrator concurred with union that the intent of the parties to pay the rate prevailing at the time the vacation and this is strengthened the fact that the company applied new vacation provisions to the vacati paid on June 27, 1947. (In re arbitrat between Lynch Corporation and Uni Automobile, Aircraft & Agricultu Implement Workers of America)

***GROUP LEADERS INCLUDED WITHIN UNIT PRODUCTION AND MAINTENANCE EMPLOYE**

Group leaders, who give out work und the supervision of the foremen, we held to be included in the unit of pr duction and maintenance employe The board found that these employe do not assign work on their own initia tive and do not make out merit ratings Only occasionally do they set up ma chinery and instruct certain employe in the performance of their duties. T general foreman neither accepts nor re ceives any information from grou leaders as to the manner in which sh employees perform their assigned duties (S-P Manufacturing Corporation an International Association of Machinist NLRB)

***HABITS OF ACTION ARE PART OF THE CONTRACT**

"A union-management contract is fa more than words on paper. It is also a the oral understandings, interpretation and mutually acceptable habits of actio which have grown up around it over the course of time." The parties to a contract must not only abide the contract itself but also by the modes of action which have become an integral part of it. Al though the contract allowed the com pany to discharge for dishonesty, the evidence disclosed that over a period of 10 years, no discharge was made by the company without first giving the union the opportunity to investigate the acti on its own. In the instant case, an employee who was guilty of theft was summarily discharged. The union was not formally notified of the company's action until the date of discharge and therefore had no opportunity to make an investigation of its own and to discuss the situation in advance with the com pany. Despite the fact that the company had substantial evidence for believing the employee guilty of theft, the arbitra tor held that in violating the established contractual procedure for handling such cases, the company breached its contract between it and the union. (In re arbitra tion between Coca-Cola Bottling Com pany of New York and International Brotherhood of Teamsters, Chauffeurs Warehousemen & Helpers of America)

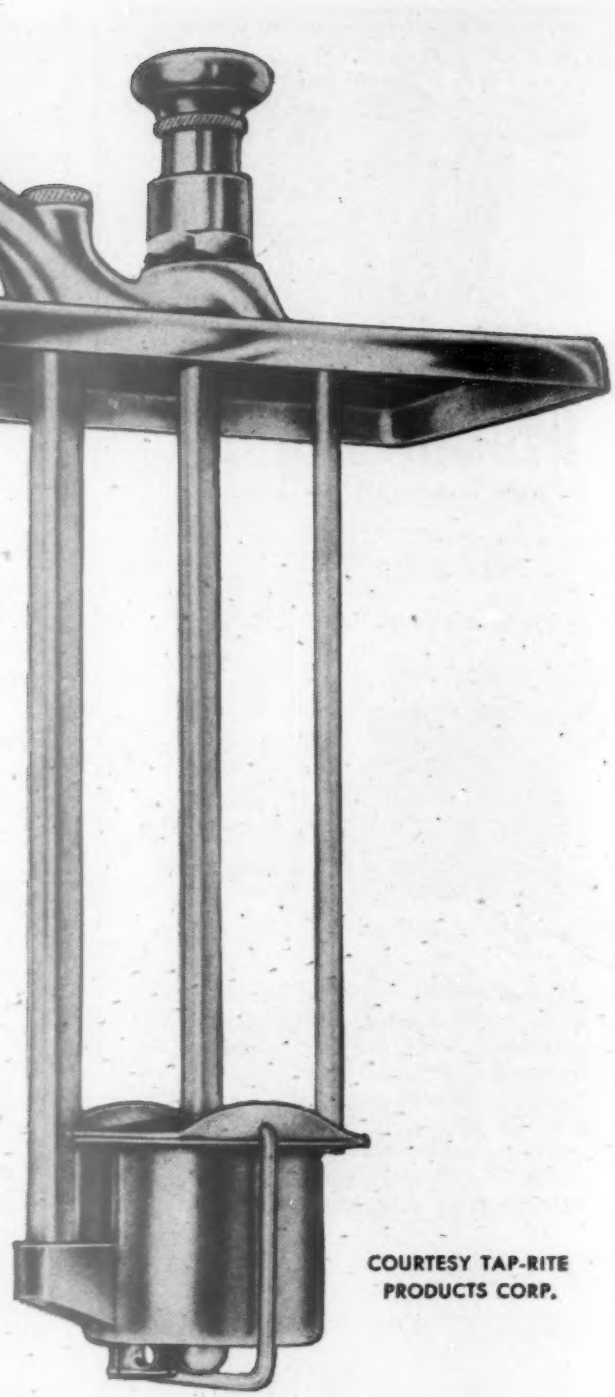
It Takes 3 Different Steels to "Make Yours Vanilla"

This syrup pump for soda fountains is readily accepted by health authorities because it's made of stainless steel.

Like many stainless products, however, this pump requires more than just a single steel. *Three* different stainless types are used—each for a specific advantage: The plunger assembly is Type 303 bar (machinability) . . . the cover plate and deep drawn cup are 302 sheet (ductility) . . . and the two fluid lines are 304 tubing (weldability). Despite this mixed requirement, all 3 forms, in the necessary analyses, are obtained *overnight* from Frasse warehouse.

In fact, you can choose from *seven* stainless types when you work from Frasse stocks. And you can work with sheets, plates, strip, tube, pipe—everything from bars to welding electrodes. All are immediately available stock items.

No matter how you use stainless steels, you'll find the wide choice and quick delivery provided by Frasse stocks a decided convenience. Send for our latest inventory. *Peter A. Frasse and Co., Inc., 17 Grand Street, New York 13, N. Y. (Walker 5-2200) • 3911 Wissahickon Avenue, Philadelphia 29, Pa. (Baldwin 9-9900) • 50 Exchange Street, Buffalo 3, N. Y. (Washington 2000) • Jersey City • Syracuse • Hartford • Rochester • Baltimore*



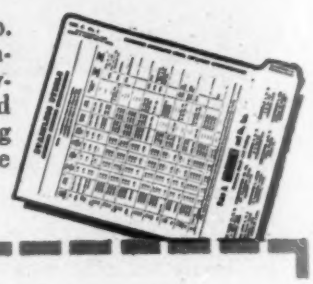
COURTESY TAP-RITE PRODUCTS CORP.

FRASSE *for Stainless Steels*

BARS • SHEETS • PLATES • STRIP • TUBES
PIPE • ANGLES • WIRE • ELECTRODES

Are you up-to-date on Stainless Analyses?

Frasse Data Chart Sec. A, No. 1 lists all 31 standard stainless steels, and chemical analysis of each. Chart is heavy card stock, file size—just the thing for wall or desk use. Send the coupon for your free copy.



Peter A. Frasse and Co., Inc.
17 Grand Street, New York 13, N. Y. 12N

☐ Please send me your latest stainless steel stock inventory.

☐ Please send me a free copy of stainless analyses chart Sec. A, No. 1,

Name..... Title.....

Firm.....

Address.....

HYDRANTS, VALVES

AND PIPE LINE ACCESSORIES

Write for Catalog No. 34

CHECK VALVE

GATE VALVE

M & H valves are used in industrial plants for water, gas, steam, oil, chemicals and are furnished in all commercial sizes from 2" to 30", inclusive. They are cast iron body, bronze mounted, furnished double disc parallel seat or solid wedge. They are heavily proportioned and have a high factor of safety.

FOR FIRE PROTECTION

M & H Tapping Sleeve and Valve above are used to tap a main under pressure for a branch to automatic sprinklers, hydrants, etc. Cut-in may be made without interrupting water service. WRITE FOR CATALOG 40

OTHER M & H PRODUCTS

Fire Hydrants
Gate Valves
Tapping Valves
Special Castings
Tapping Sleeves
B & S Fittings
Check Valves
Floor Stands
Extension Stems
Mud Valves
Flap Valves
Sludge Shoes
Flanged Fittings

M & H VALVE

AND FITTINGS COMPANY

ANNISTON, ALABAMA

THEY SAY AND DO

BEHAVIOR AS A CAUSE OF INDUSTRIAL ACCIDENTS

CLIFFORD E. JURGENSEN, Personnel Director, Minneapolis Gas Light Company, speaking before the National Safety Congress

The means for an enormous reduction of industrial injuries is at hand. There are studies dealing with the effect of behavior on accidents—behavior of individuals who are accident prone and who in their existing situation cannot avoid accidents regardless of the number of mechanical devices installed to protect them from injury and the safety propaganda to which they are exposed.

The theory of accident proneness is based on the hypothesis that all persons do not start on an equal basis, but that some persons are inherently more susceptible to accidents, and that the frequency rate within any industrial organization depends on the number of accident-prone persons employed. This theory runs counter to the "chance" theory held by most safety directors which contends that (assuming equal job hazards) accidents are distributed largely according to chance. In spite of overwhelming evidence in its favor, the accident-prone theory has not been accepted by most safety directors.

The present status of safety work shows that a radical revision is needed in our techniques for promoting safety. The most effective revision that can be made to our safety work is to give emphatic consideration to behavior as a factor in industrial accidents. This does not mean to devote all our energies to obvious behavior, such as horseplay, but to make intensive research studies which will bring to light those employees who are accident prone. We need to place less emphasis (relatively speaking) on group behavior and more emphasis on individual differences and individual behavior.

PLAN LAUNCHED TO SPREAD ECONOMIC FACTS

If the American people are to give the correct answers to communist infiltration, they have to know what the answers are, and it's up to everyone involved to see that they get them.

This statement launched a major program designed to increase the flow of accurate, economic education and thereby improve public understanding of the American system. The program was announced by the advertising industry recently through a joint committee of the Association of National Advertisers and the American Association of Advertising Agencies, 420 Lexington Avenue, New York 17.

Developed over a period of 17 months, it involves three steps.

STEP ONE

A plant and community program designed to give complete information on the strength of the American system as well as its weaknesses, the advantages of cooperation between labor and management, and, in general, what the American system does for each person individually as opposed to what happens in a totalitarian economy.

STEP TWO

A joint committee will use every type of communication and promotion at the national level to bring about a better understanding of the economic system. In addition to the economic type of institutional advertising done at the present time by several manufacturers, others will be urged to devote a portion of their budgets to this purpose.

STEP THREE

A long-range, nation-wide program of economic education will be instituted, using all the creative facilities of the advertising industry.

Distribution of the material is planned in three ways: (1) Direct to plants which write to the committee; (2) through major industries, utilizing their industry associations; and (3) through meetings in major cities.

STANDARDIZATION OF HANDLING EQUIPMENT

DAVID H. BURTON, Engineer, Bakelite Corporation, speaking before the Conference on Materials Handling at the National Materials Handling Exposition

First, is the all-important factor—safety. Unlike automobile manufacturers, materials handling equipment manufacturers have failed to standardize on operating controls or positions. We find that certain makes of trucks steer in opposite direction from the natural tendency to turn the wheel. Some are left-hand and others are right-hand drive. One type operates in speed by a pedal similar to the automobile accelerator, while others operate by circuit breaker control with either left- or right-

DESPATCH Gives Faster Finishing and Lower Labor Costs on Motorcycle Parts

Motorcycle rims emerge at right after 60-seconds Spra-Bonderite process. Metallurgist tests strength of solution at left.

Taking viscosity test in 1100-gallon prime coat enamel tank. Adjoining tank has finish coat. The 960' chain travels 4' per minute, handles 3000 lbs. of parts per hour.

Harley-Davidson, motorcycle manufacturer, now uses a complete DESPATCH Finishing System

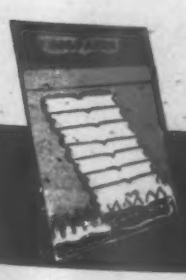
"We want *faster* finishing—greater production—in the *same* floor space at a lower labor cost per unit," said Harley-Davidson Motor Company of Milwaukee.

DESPATCH engineers supplied the answer—a *complete* finishing system with automatic conveyor which practically eliminates manual handling. An endless chain travels at 4 feet per minute, finishes 3000 lbs. of motorcycle parts per hour.

In the automatic, 5-stage DESPATCH-built, Spra-Bonderizer, the parts travel thru cleaner, hot water rinse, Bonderite, clear water rinse and final Parco-lene rinse. The parts continue thru a DESPATCH dryoff oven, then to 1100-gallon DESPATCH dip tanks for the prime coat and later for the finish coat. They are finish baked in modern, space-saving DESPATCH-built roof ovens. Gas-fired, electrically-controlled ovens bake prime coat at 400° F., finish coat at 325° F.—for 45 minutes each.

DESPATCH engineers had complete responsibility for this finishing system. With their 46 years of experience, they can help solve your finishing problems, too.

DESPATCH OVEN CO., 1060 S.E. 6th St., Minneapolis 14, Minn.



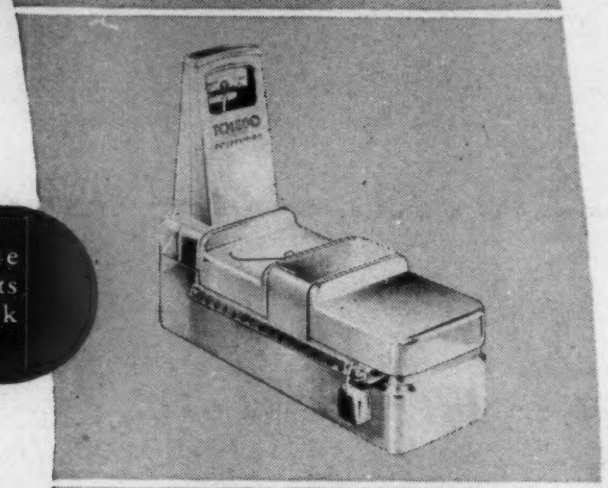
WRITE TODAY for new Bulletin A-51, complete with installation photos of ovens, Bonderizers, air make-up, etc.

BAKING OVENS • RUST PROOFERS
DRY-OFF OVENS • SPRAY BOOTHS
AIR CONDITIONERS • CONVEYORS

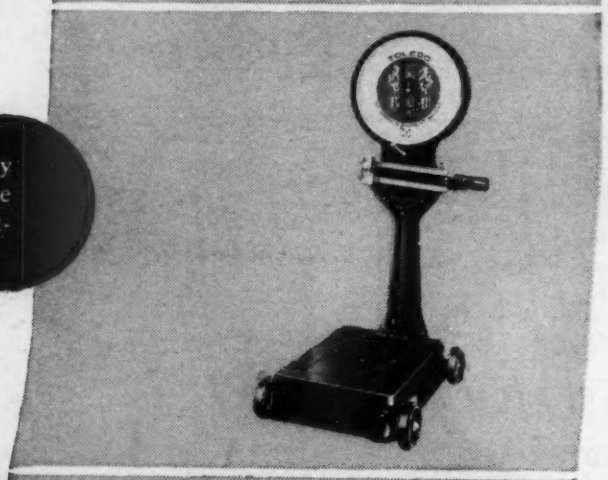
DESPATCH OVEN COMPANY

Control Costs

COUNTING SCALES—These Toledos count large quantities of small parts fast . . . ACCURATE. Eliminate slow and inaccurate hand-counting.



OVER-UNDER SCALES—The Speedweigh saves time and cuts costs in packing, filling, check weighing.



PORTABLE SCALES—Highly versatile . . . these Toledos are world's most widely used portable dial scales.

Whether it's weighing, counting, force-measuring, batching, testing or any problem in weight-control . . . it's a job for accurate Toledo Scales! They'll help you control costs, improve product-quality and increase production. Send for bulletin No. 2020. Toledo Scale Co., Toledo 12, O.

TOLEDO

HEADQUARTERS FOR SCALES

hand operation. One unit tilts by lifting a lever and elevates or lowers by pulling another lever (a direct opposite to the natural tendency for such action).

How then can we honestly feel that our warehouse crews are operating safely when we furnish them with an assortment of equipment on which some of the controls work in direct opposites?

An answer to this question might well be to assign each man a unit, teach him to operate that one and no other. But this immediately reduces the flexibility of a warehouse crew, and most warehouse crews derive their efficiency from the flexibility they have. . . .

Second, consider the important factor of maintenance and repairs. . . .

Repairs involve spare parts. It naturally follows that a manufacturer's recommended list for stock of normal operating replacement parts such as contacts, bearings, mast rollers, springs, brake linings, tires, etc., would have to be duplicated for each different type of unit in use. This, along with the somewhat intangible expense of ordering, storing, cataloging, and inventorying can easily amount to several thousands of dollars annually.

The possibility of interchange of parts on standard units allows for the operation of many units with only one down for repairs while the worn or broken parts are being ordered and installed. . . .

Third, and of considerable importance too, is the actual layout of the warehouse. It's an accepted fact that efficient warehouse operations require the use of the greatest percentage of the cubic storage area.

Standardizing on the equipment that is used provides for the most practical aisle widths. Turning radius will be uniform, ceiling heights, doorways, and head clearances will be the same, and it naturally follows that this uniformity will influence the whole efficiency.

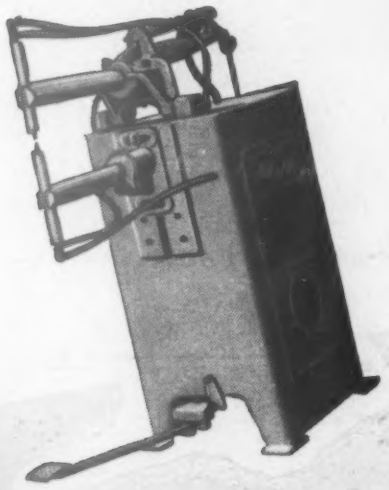
Having covered what seem to be the major points in favor of standardization, let us consider those that might justify not standardizing.

Chief among those points would be the limitations that might arise, thereby denying the exploitation for the adoption of any of the new developments that will certainly come along in this rapidly expanding field.

It's a fact that each manufacturer seeks to make his units distinctive, embracing new features and accessories that will suit the individual company's handling problems.

Another observation that may be

Here's the Economical Way to Modernize Your Small Spot Welders



Specify this NEW SQUARE D Combination Control

Single enclosed unit includes timer and contactor—eliminates human element and assures UNIFORM weld quality

Class 8992 Type BBG-1 Controllers (illustrated above) are ideal for small foot-operated or motor-operated welders. A complete line of combination controllers for air-operated machines is also available.

Write **Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin, for Bulletin 8992.**

• Unit cost and spoilage go down—production goes up, where welding power is controlled automatically. It's a simple matter to modernize old machines with this single device which does the whole job automatically—does it quicker, better, and at low installation cost. Check your welding equipment with the manufacturer or his representative. You may find that a small investment will bring a substantial improvement in both quality and output.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

SQUARE D CANADA, LTD., TORONTO, ONTARIO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

Holds to Driver for fast assembling; Stays fast in *flush* set-ups

These advantages reach all the way down to the smallest "V"-Head Cap Screws made. Illustration shows a No. 4 (stock size "Allen") held on a "Handi-Hex" Allen Driver, — fastest fastening combination for small parts in electronic devices. Positive hex-socket wrenching achieves tight set-ups; threading to high Class 3 fit *keeps* them tight... Write us for informative data and samples;

BUY FROM Your local your local ALLEN Industrial Distributor Distributor supplies the screws.

THE ALLEN MFG. COMPANY
HARTFORD 2, CONNECTICUT, U. S. A.

made in favor of diversity of materials handling equipment is the doubt that is natural in the mind of any person responsible for its use, as to whether or not his first purchased choice was the best, the most efficient, and the most practical unit.

Some individuals answer this question to their own satisfaction by keeping service records for each unit for comparison. Perhaps an exchange of these data among the individuals of several companies will substantiate or deny those records.

While this discussion has dealt primarily with mobile warehouse units, it would seem to follow that the same observations applied to all materials handling equipment. Scales, bins, lorries, hoppers, conveyors, pallets, skids, vibrators, hand trucks, and the like. At some time in the life of such equipment adjustments and repairs are necessary, and a careful consideration of the benefits of standardization in the purchase of such equipment would certainly be in order.

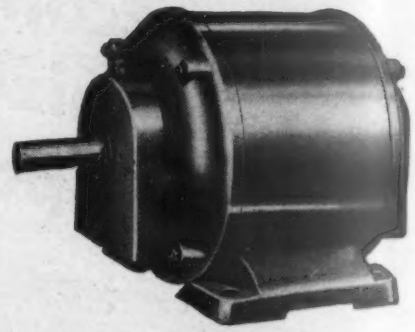
COORDINATING HANDLING WITH SHIPPING

W. BERT WATSON, Traffic Manager, H. J. Heinz Company of Canada, Ltd., speaking before the Conference on Materials Handling at the National Materials Handling Exposition.

Modern materials handling, packaging, and palletization lose effectiveness in fields of economics unless properly adapted and fitted smoothly into the shipping and receiving of freight by any means of transportation. . . We shall not and cannot realize all possible economies and operating efficiency unless we consider . . . how our mechanized handling will coordinate with shipping from our plants to the customer's plant or warehouse.

Before the conclusion of any materials handling study in any industry is given the final reading by top management, the traffic department should be consulted. The furtherance of all the benefits of any work on mechanized handling in any plant will be expanded to a surprising degree by alert traffic officers. Intra-plant and warehouse handling too often lacks coordination when the material is ready to be shipped. Every efficiency goes into the operation up to that point and then neglect to consider how it could be extended into more economical shipping, leaves many desirable features unattended. We box, package, palletize, binload, or rack material for storage, and then handle the articles individually into the shipping vehicle. Why, if economy and flexible opera-

This **MOTOR** *is holding down thousands of* **JOBS—**



Because VALLEY Ball Bearing Motors are designed and built in a wide variety of sizes and types, they are highly adaptable to fit any power requirement. Check these VALLEY advantages—

- **They take unusual power loads**
- **They are Drip proof... splash proof**
- **Economical**
- **Cool**
- **Ball Bearing**

Look to VALLEY for dependable power Units.

VALLEY
ELECTRIC CORPORATION
4221 Forest Park Blvd. • St. Louis 8, Mo.

The IDEAL STENCIL MACHINE For FASTER STENCIL CUTTING

Your shipping operation needs the speed and accuracy made possible by the eight *exclusive* Ideal features ... Automatic Carriage Action eliminates stencil fumbling... Visible cutting safeguards against "blind" errors... Minimum margins saves 25% on stencil board.

IDEAL STENCIL MACHINE CO.
Send for the facts on better shipping with the Ideal Stencil Machine.
102 Iowa Ave. • Belleville, Ill.

...are you caught in this Costly Web?

This spider web of lines is an authentic camera record of the moves involved when a worker transfers small parts from storage truck to bin. Light bulb on worker's wrist makes an actual picture of his time and effort. The same waste is repeated when the parts are taken out of storage.

...the Easy **BARRETT** way to get out!

Don't let out-moded handling methods catch you in the web of hidden costs! Cut through it with the modern Barrett System.

Barrett Lift-trucks and Skids solve storage troubles quickly and easily. Materials are simply left on skids right through storage. It eliminates all the loading and unloading, piling and unpiling. When materials are wanted from storage—*zip!*—a sweep of the Lift-truck handle and they are ready to move out.

Other moves in your plant can benefit by this same efficiency... with Barrett Lift-trucks and Skids. Inside, use them in moving materials from room to room or floor to floor; outside, in loading and unloading trucks. Materials are moved so quickly and easily that one man with a Barrett can actually outwork 3 or 4! Your Barrett engineer will gladly show you how. For more information, write...

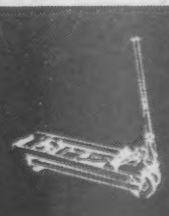
Send for your free copy of the Barrett Junior Catalog.

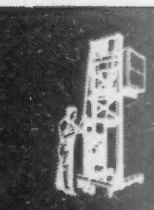
BARRETT-CRAVENS COMPANY
4618 South Western Blvd. • Chicago 9, Illinois
Representatives in All Principal Cities
Canadian Licensee: S. A. Armstrong, Ltd., Toronto, Canada

BARRETT

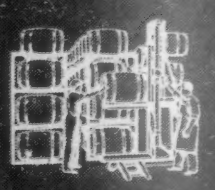
ONE MAN DOES MORE THAN 3 OR 4 . . . WITH A BARRETT

Barrett Handling Equipment





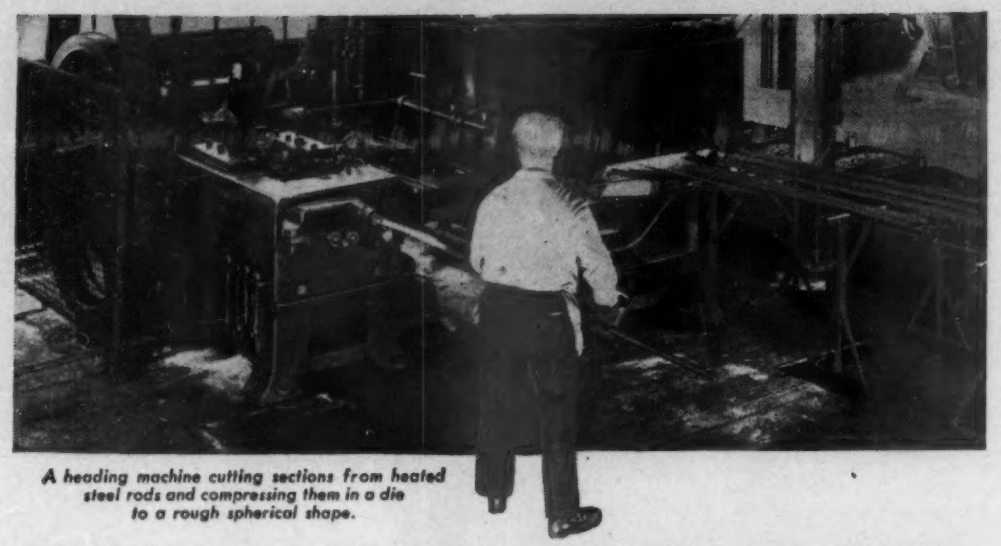
PORTABLE ELEVATORS



STEEL STORAGE RACKS

PRODUCTION

This is how STROM BALLS are born



A heading machine cutting sections from heated steel rods and compressing them in a die to a rough spherical shape.

The steel is carefully chosen and inspected, even before it gets to the heading machine. After being "born" here, balls are carefully "brought up," through a long series of grinding and lapping operations, to the unbelievably high standards of finish, sphericity and precision which have made Strom Metal Balls the standard of Industry. Strom Steel Ball Co., 1850 South 54th Avenue, Cicero 50, Illinois.

Strom BALLS Serve Industry

Largest Independent and Exclusive Metal Ball Manufacturer

"Coes" Machine Knives
BEST BY TEST

AGRICULTURAL
ENSILAGE
HAY AND STRAW
LAWN MOWER
VEGETABLE
SUGAR CANE

BOOKBINDERS
SHEARS
PASTERS
CUT-OFF
CORNER CUTTERS

DOCTOR BLADES
REFINER
LEDGER
RUBBER

LEATHER
SKIVERS
SPLITTERS
SHOE
FLESHING

PAPER AND PRINTING
GUILLOTINE
BOARD SHEARS
ELECTROTYPE
STOP CUTTERS
SHEETER
MATRIX SHEARS
RAG KNIVES
CORNER CUTTERS

TEXTILE
LEDGER BLADES
SPIRALS
LOOM BLADES

METAL SHEARS
SQUARING
ALLIGATOR

WOODWORKING
VENEER
PLYWOOD
PLANER
MOULDING
BARKER
CHIPPER

SINCE 1830
Coes
LORING COES COMPANY
WORCESTER • MASSACHUSETTS
TRADE MARK REGISTERED MICRO GROUND U.S. PATENT OFFICE

tion is enhanced by mechanical handling from machine to warehouse, cannot it be carried by the same means right into the railway car, truck, or ship, and still further desirable results and economies be obtained?

To accomplish all the desired results we must consider adapting the use of any bin, rack, pallet, or skid to extend beyond our own warehousing, and if possible to ship to final destination on the unit instead of handling to the shipping vehicle the individual packages. This will reduce handling and loading costs by 25 per cent to as much as 90 per cent, depending upon facilities and the commodity.

HOW BETTER HANDLING CUTS SHIPPING LOSSES

J. L. WEBB, Manager of Stations and Motor Service, Pennsylvania Railroad, speaking before the Conference of Materials Handling at the National Materials Handling Exposition

Packages will always require some manual rehandling. The minimum that I can see at present is one handling to your shipping room, one into a car, one out of the car to your receiving room, and one, perhaps, to a distribution point. That makes four, and beyond that you can go up to rather large figures, depending on whether your traffic is shipped carload or less carload, direct to consumer, to a distributing warehouse, and all the other multiplicities of operations which become a factor in loss and damage. . .

Every time a package is manually rehandled, you have an opportunity for damage. . . .

There are two kinds of damage—visible, and concealed. If you happen to take from us, or we take from you, packages with contents visibly damaged, that is our individual hard luck. But neither of us can tell about concealed damage. . . .

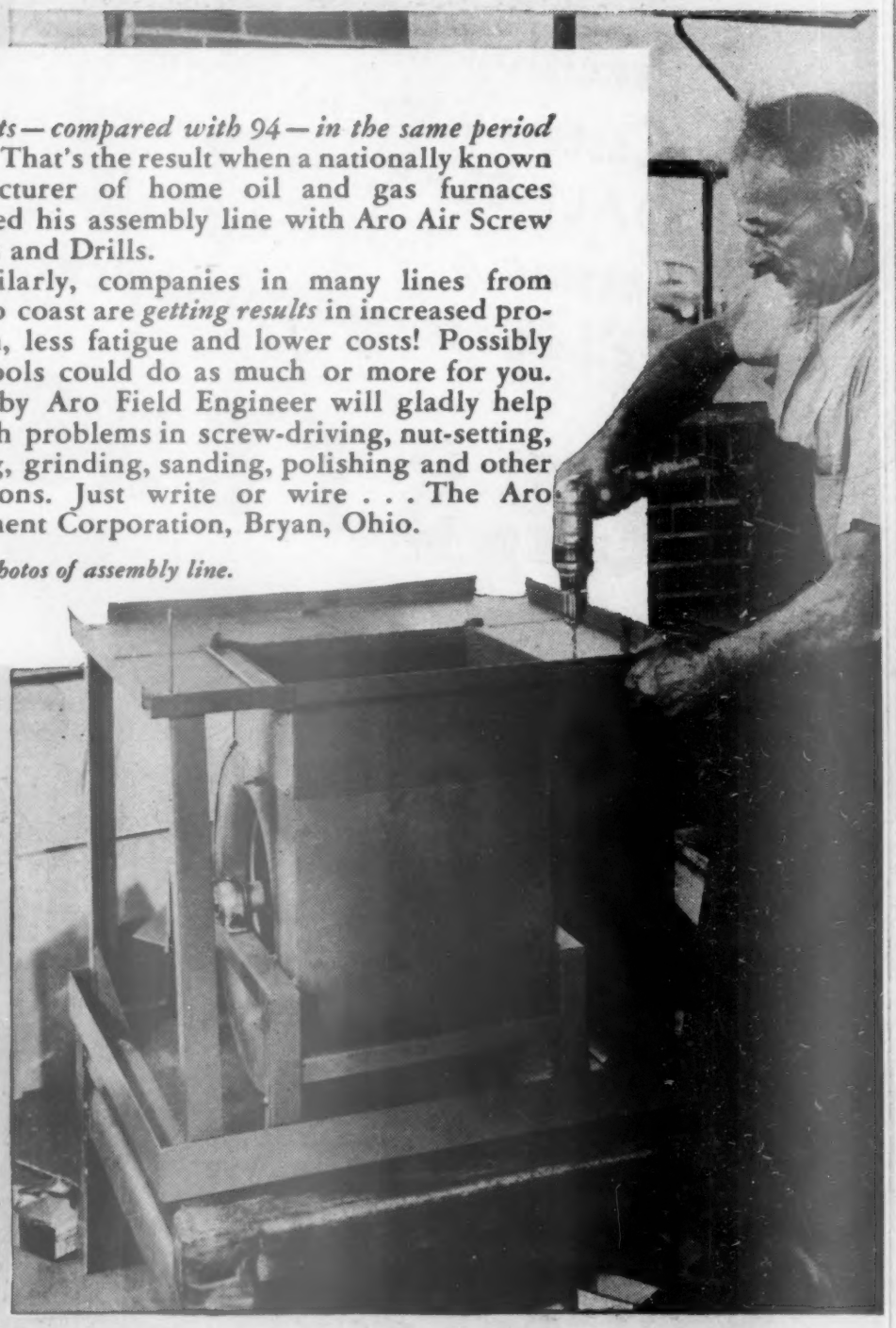
We are not talking of damage alone. We are also talking loss, and by loss I mean theft. It is easier for a man with a hand truck to go unnoticed into a secluded corner of your warehouses and our stations and cars and break open a package than it is when he is using a piece of modern freight-handling equipment. Hand trucks are everywhere, everybody knows about them, and nobody pays much attention to them, but everybody, including the freight handlers themselves, take pride in mechanical equipment and glance at it when they pass it. A glance may save a theft.

Of course, loss is not always theft from package. The railroads are

PRODUCTION

4 Times as Fast

WITH ARO TOOLS



400 units—compared with 94—in the same period of time! That's the result when a nationally known manufacturer of home oil and gas furnaces equipped his assembly line with Aro Air Screw Drivers and Drills.

Similarly, companies in many lines from coast to coast are *getting results* in increased production, less fatigue and lower costs! Possibly Aro Tools could do as much or more for you. A nearby Aro Field Engineer will gladly help *you* with problems in screw-driving, nut-setting, drilling, grinding, sanding, polishing and other operations. Just write or wire . . . The Aro Equipment Corporation, Bryan, Ohio.

Actual photos of assembly line.

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troubled with errors in loading freight and these errors mean inconvenience to our patrons and sometimes loss of the freight. As the number of truck loads are reduced, the number of possibilities of freight going astray are similarly reduced.

BEHIND THE BYLINE

Facts About FACTORY'S Authors

Clarence E. Albert (page 84) began his working life in 1932 on the Michigan Central Railroad as an air-brake repairman. In 1934 he joined United Specialties Company as a spot welder. He was promoted to personnel director in 1942. Albert prepared for personnel work in a 2-year course in personnel management and labor law at Armour Institute and De Paul University.

Rene Selver (page 100) majored in executive management and industrial engineering at New York University. After graduation, he joined the Dutchess Underwear Corporation, and shortly became superintendent of the Old Forge, Pa., plant. In 1941 he joined the Army and spent three years in Africa and Italy, participating in the invasion of each. Selver returned to Dutchess in 1946 as vice-president, responsible for coordinating all mill and sales problems.

William H. Snyder (page 102) went to work for the Consolidated Gas, Electric Light & Power Company of Baltimore after graduation from high school. He studied accounting, Spanish, Portuguese, and newspaper writing through correspondence courses and evening school. In 1938 he joined The Glenn L. Martin Aircraft Company and worked for three years as an expediter. Later he served as staff assistant to the production manager. The company's wartime indoctrination courses for new employees gave him the opportunity of addressing

HERE'S HOW Pangborn K.O.'s THE DUST HOG

. . . AND SAVES MONEY FOR THESE PLANTS

METAL SPECIALTIES

CASE 263

PROBLEM: *Metallic dust*

Actual figures, before and after installing, prove PANGBORN saves this user approximately $8,000 per year, over and above increased efficiency of workers and improved quality of work.

FOUNDRIES

CASE 1573

PROBLEM: Burned sand

Pangborn equipment corrects problem impairing workers' efficiency, slowing down production. In addition, rings up indirect savings of 25%. Negligible operating and maintenance costs prove PANGBORN a good investment.

MILLS

CASE 2346

PROBLEM: *Feed dust*

User reports salvage of $50 per day. Maintenance and operating costs so slight Pangborn system has paid for itself many times over.

CAR MFRS.

CASE 3472

PROBLEM: Foundry and machine dust

Savings in salvage and increased efficiency of workers convince this user that the installation of 20 Pangborn collectors was a good investment.

The hungry, profit-consuming "Dust Hog of Industry" always takes the count when he meets up with PANGBORN Dust Control Equipment. The cases shown here are typical examples. PANGBORN has enabled these plants to turn their dust losses into profits, through salvage of waste materials and increased efficiency of workers with better working conditions.

These are just four cases picked out of a survey among PANGBORN users. A substantial percentage of those users surveyed said their systems were practically paying for themselves in direct reclamation of dust by-products.

A PANGBORN "Dust Pocket Survey" of your plant by experienced PANGBORN engineers *at no cost to you* may reveal similar opportunities to turn dust losses into profits. For complete information on Pangborn Dust Control Equipment, write for Bulletin 909A.

PANGBORN CORPORATION, 282 Pangborn Blvd., Hagerstown, Md.

Pangborn DUST CONTROL

Turns Dust Losses Into Profits